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E-Journals Download Patterns using Web Log Analysis of Selected Publishers among the Aerospace Organizations of Bangalore: A Research Study

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Abstract- With the widespread use of computer and network technologies for facilitating access to scholarly journals, a new methodology has emerged for studying journal usage and scholarly information seeking behavior. Computers record or log all user transactions in a plain text file known as a 'transaction log'. Log files contain data about many of the details of the user's interaction with the system. Hence, some researchers have adopted log analysis to find out about the use of electronic journals in terms of both the volume and patterns of use. Web log analysis or the Transaction log analysis has immense potential for studying online journal's use and their user's information seeking behavior. Log studies have been particularly helpful in understanding the searching and browsing behavior of e-journals' users. Most importantly, the data generated from 'log analysis' is 'pure', and most importantly 'without human intervention'. Hence the authenticity of the data is guaranteed. The major findings that the authors would like to report in this paper are: Analysis of Variance (ANOVA) was applied for testing the significant difference among the mean scores attained from the aerospace scientists and engineers of the 5 aerospace organizations selected for the study for 'e-Journal downloads per year / per publisher'. It is observed that all the 5 aerospace organizations show a significant difference ($P < 0.05$) in their mean scores viz., 'Elsevier', John Wiley (Inter-Science)', 'Cambridge University Press (CUP', 'Oxford University Press (OUP)', 'American Mathematical Society (AMS)', 'American Chemical Society (ACS)', 'American Institute of Physics (AIP)', 'Indian National Science Academy (INSA)', 'Indian Academy of Sciences (IAS)', 'Royal Society of London (RSL)', 'Journal of Atmospheric Sciences (JAS)', 'Air Force – Airman' and 'Aircraft Engineering and Aerospace Technologies (AEAT)' *except for* 'Springer Link', 'Taylor and Francis (T&F)', 'Emerald (P=0.067)', 'Blackwell', 'American Institute of Aeronautics and Astronautics (AIAA) (P=0.057)', 'American Society of Mechanical Engineers (ASME)', 'American Society of Civil Engineers (ASCE)', 'Elsevier – Science Direct (P=0.054)', 'Royal Society of Chemistry (RSC)', 'Web of Science' and 'Institution of Electronics and Electrical Engineers (IEEE) (P=0.085).

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I. Introduction

In the context of exploding aviation activity in the Asian region in general and India in particular, aerospace is seen as a key technology. Indian aerospace scientists and engineers currently working on strategically important projects depend heavily on rapid collection of information from various e-information resources. Seeking information through e-resources is an upcoming and endearing activity. The use of Electronic Information Resources is highly expected from the aerospace scientists and engineers particularly as an Integrated Information System to their Learning and Working environment.

Let us first try to understand as to why the Web Server Transaction Log Analysis Methodology plays an important role in understanding the e-journal full-text download patterns. Web server transaction log file analysis is a network-based assessment technique that is particularly useful when performed in conjunction with other ongoing activities *(Nicholas, et al., (2006).* Generally, the intent of the Web server log analysis is multi-purpose: First, one can determine the overall Web site traffic including the location of users, the portions of the site accessed, and the number of document downloads; Second, one can determine the Web site directory traffic including the location of users, portions of the site accessed, and the number of document downloads (both hits and accesses); third, one can experiment with developing new log analysis techniques that go beyond domain, hit, and browser counts; and finally, one can assist government agencies to develop, implement, and maintain ongoing log file analysis.

Even though there is a debate about the reliability of the results of the log analysis, this methodology has immense potential for studying online journals' use and their users' information seeking behaviour. With the widespread use of computer and network technologies for facilitating access to scholarly journals, a new methodology has emerged for studying

journal usage and scholarly information seeking behaviour. Computers record or log all user transactions in a plain text file known as a "transaction log". Log files contain data about many of the details of the users' interaction with the system. Hence, some researchers have adopted log analysis to find out about the use of electronic journals in terms of both the volume and patterns of use.

Web server log analysis technique generally involves a three-fold process that includes determining the types of information server administrator and decision makers need; developing a program that can parse through, manipulate, and present value-added information from the log files; and analyzing the information generated from the program. Web servers automatically generate four different log files: access logs (e.g. hits), agent log (e.g., browser, operating system), error log (e.g. download aborts), and referrer logs (e.g. referring links). These files are text files that can range in size from 1 KB to 100 MB, depending upon the traffic at a particular site. Distinction between a hit and an access is critical to understanding the type of data contained in these files. A hit is any file from a web site that a user downloads. Download of a Web page with 6 images on it accounts for 7 hits (6 images + 1 text page). An access (or a page hit) is an entire page download regardless of the number of images, sounds, or movies on the page. Download of a web page with 6 images accounts for only one access.

Log studies have been particularly helpful in understanding the searching and browsing behaviour of e-journals' users. To sum up, log analysis is clearly useful for certain kinds of analyses, like shedding light on the format of the articles scientists read (PDF or HTML), the age of the articles (obsolescence), and the way scientists navigate to the required material (searching and browsing behaviour). The results of log analysis should be enhanced by a triangulation of the findings of studies with other methodologies (e.g. employing a combination of log analysis, questionnaire surveys and observation studies).

The value of this study is further enhanced in using tools like the Web Log Analysis, which ensures that the data remains 'unfiltered', 'pure', and most importantly without 'human intervention'. Applying such tools further ensures authenticity of the data analyzed.

In this research study among the 16 reputed aerospace organizations of Bangalore, a different type of questionnaire (as part of a related major survey of 'Use Patterns of Electronic Information Resources among the Aerospace Scientists and Engineers of Bangalore') was distributed among the Chief Librarians, Web Administrators and Network Administrator to ascertain the full-text e-journal downloads from their respective Server Log Data.

Amongst the 16 aerospace organizations selected for the study only 7 aerospace organizations responded to this questionnaire, namely: (a) National Aerospace Laboratories (NAL), Bangalore, (b) Aeronautical Development Agency (ADA), (c) Indian Space Research Organization (ISRO), (d) Jawaharlal Nehru Centre for Advanced Scientific Research (JNCASR), (e) Indian Institute of Science (IISc), (f) Electronics Research Development Establishment (LRDE) and finally, (g) Hindustan Aeronautics Limited (HAL).

It was presumed that only the above organizations had access to server log data. Out of these 7 organizations, information from two organizations was not usable (incomplete). Hence, the remaining 5 organizations, namely: NAL, ADA, ISRO, JNCASR, IISc responded to the questionnaire and these were selected for the Study.

II. Review of Literature

Several interesting studies came to light on using web log analysis in analyzing the use patterns of electronic journals. Some of these studies are: *Zhang (1999)* discusses the method of www server log file analysis and its application to evaluating electronic periodicals services and in monitoring their usage. *Nicholas and Huttington (1999)* reports results of an investigation into ways of using web logs to study user behaviour on the WWW, based on a detailed examination of the Web logs of the Times/Sunday Times. *Yu and Apps (2000)* report the experience of using the log file data to understand user behaviour in the SuperJournal project, addressing methodological and analytical issues that may have wider relevance. *Thelwall (2001)* describes that web log files are a useful source of information about the visitor's site use and navigation behaviour. *Hochheiser and Shneiderman (2001)* report that HTTP server log files provide web site operators with substantial detail regarding the visitors to their sites. *Dias (2002)* presents an approach to the evaluation of access to electronic journals available on the World Wide Web through the analysis of the access log file. *Marek and Valauskas (2002)* opine that the development of World Wide Web based scholarly periodicals offers new tools, such as server logs, for tracking an article's use and distribution. A study was undertaken in which logs recording the use of First Monday were examined in order to understand the use of the periodical's content over time. *Griffiths (2002)* reports a novel approach to studying user-system interaction that captures a complete record of the searcher's actions, the system responses and synchronized talk-aloud comments from the searcher. *Jantz (2003)* observes that transaction log analysis can provide a rich source of information on user behaviour and insights as to how user interfaces can be improved. *Kassim and Kochtanek (2003)* describe the five-stage evaluation of an educational digital library resource

(www.coe.missouri.edu/rafee/idigital/libraryR/indes.php). The five evaluation methods used were focus group reviews, web log analysis, database transaction logs, a web survey, most recently a report usability evaluation. *Marchionini (2003)* describes a series of user studies that were used to advance understanding of how people use electronic tables (E-tables) and inform the development of a web-based statistical table browser for use by non-specialists. *Cohen (2003)* proposes a two-tiered model for analyzing website usage statistics for academic libraries. *Baeza-Yates and Saint-Jean (2003)* state that the information left by users as they use a browser can be used to complement the result of traditional hierarchy algorithms in such a way as to allow human knowledge to be added to the result. *Chien (2003)* proposes an effective term suggestion approach to interactive web search and present a new, effective log-based approach to relevant term extraction and term suggestion. *Homewood (2003)* states that transaction log files generated by digital information services do record the pages (topics or content) viewed by users and this is perhaps the most interesting aspect of the logs. *Huntington and Nicholas (2003)* propose improved ways of analyzing web server files using transaction log and deep log analysis techniques. *Abe (2003)* describes the Tokyo Shika Daigaku (Tokyo Dental College) Library's analysis of its website access logs to inform future developments.

Davis (2004) analysed referral URL data of the Cornell University IP address from the American Chemical Society servers, to better understand the tools used and pathways taken when scientists connect to electronic journals. *Bracke (2004)* explores the potential of multinomial logistic regression analysis to perform web usage mining for an academic health sciences library web site. *Kato (2005)* reviews the current state of electronic journals: He discusses particularly the number of electronic journals, merger and acquisition of publishers, flip pricing, use of large national universities, transaction log analysis and impact of ILL. *(Jansen (2005)* reports research that used transaction log analysis to examine the characteristics and changes in Altavista web searching that occurred from 1998 to 2002. *Combs (2005)* examined why State University of New York at Cortland, New York, chose web server logs as the technique for tracking who was using the Library's web sites. *Simunic (2005)* says that a log file is a carrier of numerous data and indicators that should be used in the best possible way to improve the entire business operations of a company. However, this is not always simple and easy. *Park (2005)* analysed transaction logs of NAVER, a major Korean web search engine to track the information seeking behaviour of Koren web users. Results showed that users also behave in a passive way: they seldom change search environments set by the system. Also, generally users tend to change their queries totally rather than adding or deleting terms to modify the previous queries. *Jamali (2005)* reviewed the log analysis studies of use and users of scholarly electronic journals. The advantages and limitations of log analysis are described. There is a debate about reliability of the results of log analysis, this methodology has great potential for studying online journals' use and their users' information seeking behaviour. *Sherry (2006)* reports on results from a transaction log analysis of vivisimd.com, which is a web meta-search engine that dynamically clusters users' search results. The results provide insights into search characteristics with a cluster-based web search engine and extend research into web searching trends. *Lau and Goh (2006)* conducted a transaction log analysis of the Nanyang Technological University (NTU) OPAC to identify query and search failure patterns with the goal of identifying areas of improvement for the system. *Shih (2006)* studied Web Crawler activities based upon web access logs from the web site of an academic library. He compared crawler behaviour with that of regular human visitors. *Yun (2006)* in his paper examined the validity of the client-side and server-side web log data. As a result of the triangulation of two datasets, research designs and propose analysis schemes could be recommended. *Koch (2006)* undertook a study to explore the navigation behaviour of all users of a large web service, Renardus, using web log analysis. *Proffitt (2006)* provides specific case studies of usability studies, focus groups, interviews, web log analysis etc. His paper provides practical advice and tools for those interested in exploring user-centred design concepts for web-based tools and services in archives, libraries and museums. *Nicholas and Huntington (2006)* made a detailed analysis of the use of OHIOLink as well as the Blackwell Synergy, Science Direct, emerald insight, and OUP databases by CIBER at University College, London, to quantify the usage of electronic journals as an aid to making judgements on the use of document supply. "Deep log" analysis sheds valuable light on the actual as distinct from perceived use of electronic full text databases.

Meats (2007) studied the Web log analysis undertaken of the TRIP database-a-meta-search engine covering 150 health resources including MEDLINE, the Cochraine Library, and a variety of guidelines. Web log analysis showed most searches used a single term and no Boolean operators. *Goddard (2007)* by looking at logs, reports and data sources from proxy servers, makes a survey of data sources which are likely to be immediately available to the typical practitioner who wishes to engage in statistical analysis of collections and services within his or her own library. *Nicholas (2007)* describes an emerging, but significant, form of digital information seeking behaviour among information consumers, called 'bouncing'. The evidence for this behaviour emerged from five years of deep log analysis studies – an advanced form of transaction log analysis –

of a wide range of user of digital information resources. Evidence shows that (1) a high proportion of people view just a few times or pages during a visit to a site and, (2) a high proportion of visitors either do not come back to the site or they did so infrequently. Typically those who penetrated a site least tended to return the least frequently. These 'bouncers' bounce into the site and then bounce out again, presumably, to another site, as a high proportion of them do not appear to come back again. *Villen-Rueda (2007)* looks at how different types of users effect queries in the catalog of a university library. Log files were analysed to determine which was the frequent type of search conducted among different user types. *Harley and Henke (2007)* state that there is little empirical data about how intellectual and cultural resources are actually used or who is using them. Transaction log analysis (TLA) and online site surveys were conducted by the authors. *McCain (2007)* reports the results of one academic librarian's reference desk transaction log analysis which focuses on the categories of assistance provided to patrons who called the library's reference desk. *Ravid (2007)* report that LogFile analysis of SHIL, the website of Israeli Citizens' Advice Bureau, revealed that about 60.7 percent of the requests reaching SHIL from external sites (excluding requests from robots) are from general search engines (e.g. Google and MSN), and users reach a specific page on the site linked from the search results page. *Huntington (2007)* analysed search logs from the BBC website and extracted metrics. Two search metrics – the time lag between searches and the number of searches in a session – were developed to see whether they could measure search success or satisfaction. He made a unique analysis that related questionnaire data to site usage as recorded in the transaction log reports of ScienceDirect, for the same people. They studied the online behaviour of three types of navigational users: those accessing the site via a gateway (either via a reference hyperlink or subject search facility), those using the on site search facility and those employing menus. *Nicholas (2007)* evaluated the logs of four universities using the OhioLink journal system for a period of fifteen months using deep log analysis methods in order to compare and contrast the information seeking behaviour of their users. Large differences were found, especially between the research and teaching universities. *Whittle (2007)* describes a novel method for the analysis of web logs, using techniques that look for similarities between queries and identify sequences of 'query transformation'.

Nicholas (2008) demonstrated a novel form of deep log analysis by linking questionnaire data with transactional server log data generated by the same users; and to provide a richer understanding of the information seeking behaviour of a strategic community of virtual scholars. He studied usage data on a large scale in respect to full-text down loads of journal articles, which is considered an important usage metric by librarians and publishers. Results showed that there is a great deal of variety amongst scholars in their full text viewing habits and a large proportion of views are very cursory in nature, although there is a survey evidence to suggest that reading goes on offline. *Galyan and Moballeghi (2008)* review the methodologies employed by researchers working on scientific journals usage. *Huntington (2008)* reports that metrics derived from user visits or sessions provide a means of evaluating websites and an important insight into online information seeking behaviour, the most important of them being the duration of sessions and the number of pages viewed in a session, a possible busyness indicator. *(Wolfram 2008)* analyzed transaction logs from four different web-based information retrieval environments (bibliographic databank, OPAC, Search engine, specialized search system) for empirical regularities in search characteristics to determine whether users engage in different behaviours in different web-based search environments. *Nicholas (2008)* describes a novel form of deep log analysis by linking questionnaire data with transactional server log data generated by the same users; and provide a richer understanding of the information-seeking behaviour of a strategic community of virtual scholars. *Hider and Pymm (2008)* describe a content analysis aimed at identifying the distribution of empirical research strategies and techniques reported in high-profile LIS journal literature published in 2005. *Guruprasad, Nikam, et al. (2009)* present a case study of full-text e-journal patterns amongst the scientists and engineers at the National Aerospace Laboratories (NAL). The analysis of data on the full-text e-journal patterns is presented for the period 2005 to 2007 with regard to 4 international journal publishers. *Guruprasad, Nikam, et al. (2009)* in their paper present a detailed web log analysis of e-journal usage and scholarly communication , a case study of e-journal download patterns taking NAL Scientists and Engineers. Their study was conducted with regard to 8 international journal publishers whose downloaded data has been analyzed for 3 consecutive years, i.e. 2005.2007. *Nicholas, D., et al. (2009),* In this research, data were gathered as part of CIBER's ongoing Virtual Scholar programme. In particular log data from two digital journals libraries, Blackwell Synergy and OhioLINK, and one e-book collection (Oxford Scholarship Online) are utilized. The study showed a distinctive form of information-seeking behaviour associated with students and differences between them and other members of the academic community. For example, students constituted the biggest users in terms of sessions and pages viewed, and they were more likely to undertake longer online sessions. Undergraduates and postgraduates were the most likely users of library links to access scholarly databases, suggesting an important "hot link" role for libraries, *Nicholas, et. Al (2010),* in their

paper present some of the results of the project "Evaluating the usage and impact of e-journals in the UK". The particular research evaluated the use of the Science Direct journals database with regard to Life Sciences, Economics, Chemistry, Earth & Environmental Sciences and Physics by ten major UK research institutions. The aim of the study is to investigate researchers' digital behaviour, and to ascertain whether their use and behaviours varied by subjects and disciplines, or in relation to the institutions in which they worked. The methodology they adopted was in studying the raw logs which were obtained for Science Direct for the period January to April 2007. They were subjected to deep log techniques and analzed using the Software Package for Social Sciences (SPSS).

III. National Aerospace Laboratories, Bangalore and Allied Aerospace Organizations in Bangalore: The Scope of the Present Study

The city of Bangalore, Karnataka is considered the 'Aerospace Hub' of the country with many key aerospace organizations which have already been established several years ago like (a) The Hindustan Aeronautics Limited (HAL), (b) The National Aerospace Laboratories (NAL), (c)The Aeronautical Development Establishment (ADE), (d) The Indian Space Research Organization (ISRO), (e) The Aeronautical Development Agency (ADA). It also comprises many key Indian Air Force establishments like (a) Air Force Systems and Testing Establishment (ASTE), (b) Air Force Technical College (AFTC) and the (c) Institute of Aviation Medicine (IAM). In a nutshell, many of these organizations come under the broad umbrella of (i) Council of Scientific and Industrial Research (CSIR), (ii) Defense Research and Development Organizations (DRDO), (iii) The Indian Air Force (IAF), (iv) Educational Institutions like IISc, and (v) Major public sector undertakings and (vi) The Department of Space. All of them in their own way have significantly contributed to a large number of Indian aerospace programmes.

The National Aerospace Laboratories is India's premier civil aviation R & D aerospace research organization in the country. Its main mandate is the 'Development of aerospace technologies with strong science content and with a view on their practical application to the design and construction of flight vehicles'. NAL is also required 'to use its aerospace technology base for general industrial applications'. 'Technology' would be its core engine-driver for the future. NAL is also best known for its main sophisticated aerospace R&D testing facilities which are not only unique for this country but also comparable to similar facilities elsewhere in the world.

IV. Objectives of the Study

- To determine the 'e-Journal downloads per year / per publisher', amongst the aerospace scientists and engineers of the selected 5 aerospace organizations of Bangalore.
- To ascertain whether the percentage of preference of 'e-Journal downloads per year / per publisher', amongst the aerospace scientists and engineers of the selected 5 aerospace organizations of Bangalore are approximately the same.
- To study whether there exist similar patterns (homogeneous) of 'e-Journal downloads per year / per publisher' among the selected aerospace organizations of Bangalore.

V. Null Hypothesis

There is no significant difference in the mean scores of 'e-Journal downloads per year / per publisher' from the selected aerospace organizations of Bangalore.

VI. Material, Methods, Scope and Limitations of the Study

The present study is part of a larger survey of the 'Use Patterns of Electronic Information Resources among the Aerospace Scientists and Engineers of Bangalore'. A total number of 650 survey questionnaires were distributed amongst the aerospace scientists and engineers belonging to these 16 aerospace organizations. A total number of 612 questionnaires were received back finally 583 (89.7%) were selected for the study which were found suitable for the study.

A survey questionnaire has been used to conduct this research study. The total population size of this research study is restricted to the 1220 aerospace scientists and engineers in Bangalore. The distribution of Source Data is indicated in *Table 1*. Random sampling technique has been used for selection of the sample size. *Table 2* describes the Full-Text e-Journal Downloads Amongst Selected the 5 Aerospace Organizations (Yearly Average of e-Journal Downloads Per Publisher).

However, the work presented in this paper ('e-Journal downloads per year / per publisher') is restricted to 7 reputed aerospace organizations in Bangalore. A different type of Questionnaire was circulated to the (a) Chief Librarians, (b) Net Work Administrators, (c) Web-In-Charge and (c) Web Log Server Data Administrators.

The present study of 'e-Journal downloads per year / per publisher' is for the years 2005-2008 and restricted to 24 reputed e-journal publishers only.

The study also has looked into the Cumulative e-Journal Downloads for the Period (2005-2008) among the selected 24 publishers related to the 7 aerospace organizations selected for the study.

VII. Results and Discussion

- Summary of Total Mean Scores on e-Journal Downloads Per Year / Per Organization

The summary of total scores obtained with regard to 'e-Journal Downloads Per Year / Per Organization' amongst the selected 7 Aerospace Organizations are as follows: The highest mean score of 44421.75(CV=308.15) is reflected by 'Elsevier – Science Direct'. This is followed by a mean score of 43972.42(CV=233.79) by the respondents of 'Web of Science'. This is followed by the respondents of 'Elsevier' with a mean score of 5676.15(CV=233.22). The respondents of 'Springer Link' reflect themselves with a mean score of 4241.70(CV=338.28). This is followed by a mean score of 1021.85(CV=283.22) by the respondents of 'American Society of Mechanical Engineers (ASME)'. The respondents of 'Emerald' come up with a mean score of 560.00(CV=315.22). A mean score of 510.05(CV=230.87) is accrued by the respondents of 'John Wiley – Inter Science'. This is followed by the respondents of 'American Institute of Physics (AIP)' with a mean score of 286.85(CV=271.23). A mean score of 265.05(CV=351.80) is accrued by the respondents of 'American Society of Civil Engineers (ASCE)'. The respondents of 'Cambridge University Press (CUP)' present themselves next with a mean score of 62.30(CV=186.38). A mean score of 47.26(CV=289.06) is reflected by the respondents of 'American Chemical Society (ACS)'. This is followed by a mean score of 38.25(CV=350.58) by the respondents of 'Taylor and Francis (T&F)'. The respondents of 'Oxford University Press (OUP)' express themselves with a mean score of 34.90(CV=219.91). A mean score of 33.90(CV=342.83) is accrued by the respondents of 'Royal Society of Chemistry (RSC)'. This is closely followed by a mean score of 30.65(CV=179.11) by the respondents of 'Royal Society of London (RSL)'. The respondents of 'Institution of Electronics and Electrical Engineers (IEEE)' reflect themselves with a mean score of 20.95(CV=323.57). The respondents of 'Blackwell' project themselves with a mean score of 9.25(CV=343.54). This is followed by the respondents of 'American Institute of Aeronautics and Astronautics (AIAA)' with a mean score of 1.35(CV=309.93). The lowest mean score of 0.55(CV=247.27) is portrayed by the respondents of 'Aircraft Engineering and Aerospace Technologies (AEAT)'. The respondents of 'American Mathematical Society (AMS)', 'Indian National Science Academy (INSA)', 'Indian Academy of Sciences (IAS)', 'Journal of Atmospheric Sciences' and 'Air Force – Airman' express themselves with similar mean scores 0.00 each and aggregate corresponding CV values of 0.00 each.

- *Analysis of Variance (ANOVA)* was applied fortesting the significant difference among the meanscores attained from the scientists and engineers of the 5 aerospace organizations (described above in table 2) for the 'e-Journal downloads per year / per publisher'. It is observed that all the 5 aerospace organizations show a significant difference ($P < 0.05$) in their mean scores viz., 'Elsevier', John Wiley (Inter-Science)', 'Cambridge University Press (CUP', 'Oxford University Press (OUP)', 'American Mathematical Society (AMS)', 'American Chemical Society (ACS)', 'American Institute of Physics (AIP)', 'Indian National Science Academy (INSA)', 'Indian Academy of Sciences (IAS)', 'Royal Society of London (RSL)', 'Journal of Atmospheric Sciences (JAS)', 'Air Force – Airman' and 'Aircraft Engineering and Aerospace Technologies (AEAT)' *except for* 'Springer Link', 'Taylor and Francis (T&F)', 'Emerald ($P=0.067$)', 'Blackwell', 'American Institute of Aeronautics and Astronautics (AIAA) ($P=0.057$)', 'American Society of Mechanical Engineers (ASME)', 'American Society of Civil Engineers (ASCE)', 'Elsevier–Science Direct ($P=0.054$)', 'Royal Society of Chemistry (RSC)', 'Web of Science' and 'Institution of Electronics and Electrical Engineers (IEEE) ($P=0.085$)
- The study also reveals that the most preferred file formats for e-journal downloads happens to be PDF (NAL, ISRO) while the others (ADA, JNCASR and IISc) have chosen both PDF HTML and MS-Word.

VIII. Conclusions

The main conclusions that we would like to draw from this study are:

- *Analysis of Variance (ANOVA)* was applied for testing the significant difference among the mean scores attained from the scientists and engineers of the 5 aerospace organizations for the 'e-Journal downloads per year / per publisher'. It is observed that all the 5 aerospace organizations show a significant difference ($P < 0.05$) in their mean scores viz., 'Elsevier', John Wiley (Inter-Science)', 'Cambridge University Press (CUP', 'Oxford University Press (OUP)', 'American Mathematical Society (AMS)', 'American Chemical Society (ACS)', 'American Institute of Physics (AIP)', 'Indian National Science Academy (INSA)', 'Indian Academy of Sciences (IAS)', 'Royal Society of London (RSL)', 'Journal of Atmospheric Sciences (JAS)', 'Air Force – Airman' and 'Aircraft Engineering and Aerospace Technologies (AEAT)' *except for* 'Springer Link', 'Taylor and Francis (T&F)', 'Emerald ($P=0.067$)', 'Blackwell', 'American Institute of Aeronautics and Astronautics (AIAA) ($P=0.057$)', 'American Society of Mechanical Engineers (ASME)', 'American Society of Civil Engineers (ASCE)', 'Elsevier–Science Direct ($P=0.054$)', 'Royal Society of Chemistry (RSC)', 'Web of Science' and 'Institution of Electronics and Electrical Engineers (IEEE) ($P=0.085$).

- This also implies that, the percentage of preference of the 'e-Journal downloads per year/ per publisher'. by the aerospace engineers and scientists are not approximately the same, *except for* 'Springer Link', 'Taylor and Francis (T&F)', 'Emerald (P=0.067)', 'Blackwell', 'American Institute of Aeronautics and Astronautics (AIAA) (P=0.057)', 'American Society of Mechanical Engineers (ASME)', 'American Society of Civil Engineers (ASCE)', 'Elsevier–Science Direct (P=0.054)', 'Royal Society of Chemistry (RSC)', 'Web of Science' and 'Institution of Electronics and Electrical Engineers (IEEE) (P=0.085).
- The study also reveals that there is heterogeneity in the 'e-Journal downloads per year / per publisher', amongst the aerospace scientists and engineers of the selected 7 aerospace organizations of Bangalore, *except for* 'Springer Link', 'Taylor and Francis (T&F)', 'Emerald (P=0.067)', 'Blackwell', 'American Institute of Aeronautics and Astronautics (AIAA) (P=0.057)', 'American Society of Mechanical Engineers (ASME)', 'American Society of Civil Engineers (ASCE)', 'Elsevier – Science Direct (P=0.054)', 'Royal Society of Chemistry (RSC)', 'Web of Science' and 'Institution of Electronics and Electrical Engineers (IEEE) (P=0.085).
- PDF format happens to be the most preferred 'File Download Format' amongst the selected aerospace organizations.

IX. Acknowledgements

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Tables and Figures

Table 1 : Distribution of Source Data

Sl.No.	Organizations	No. of Questionnaires distributed	No. of Questionnaires received	No. of usable questionnaires usable
1.	ADA	67	63	58
2.	AFTC	19	16	15
3.	ADE	14	12	12
4.	ASTE	33	30	29
5.	CABS	16	15	14
6.	CEMILAC	33	30	29
7.	C-MMACS	8	6	6
8.	DARE	11	9	9
9.	LRDE	5	3	2
10.	GTRE	24	22	21
11.	HAL	144	140	134
12.	IAM	40	36	33
13.	ISRO-ISTRAC	25	24	22
14.	IISc	38	37	34
15.	JNCASR	5	3	1
16.	NAL	168	166	164
Total		**650**	**612**	**583 (89.7%)**

Geographical Boundary of the Sample: 16 Prominent Aerospace Organizations of Bangalore, INDIA

Key: ADA=Aeronautical Development Agency, *AFTC*=Air Force Technical College, *ADE*=Aeronautical Development Establishment, *ASTE*=Aircraft Systems Testing Establishment, *CABS*=Centre for Airborne Systems, *CEMILAC*=Centre for Military Airworthiness and Certification, *C-MMACS*=Centre for Mathematical Modeling and Computer Simulation, *DARE*=Defense Avionics Research Establishment, *LRDE*=Electronics and Radar Development Establishment, *GTRE*=Gas Turbine Research Establishment, *HAL*=Hindustan Aeronautics Limited, *IAM*=Institute of Aerospace Medicine, *ISRO-ISTRAC*=Indian Space Research Organization, *IISc*=Indian Institute of Science, *JNCASR*=Jawaharlal Nehru Centre for Advanced Scientific Research, *NAL*=National Aerospace Laboratories.

Table 2 : Full-Text e-Journal Downloads Amongst Selected the 5 Aerospace Organizations (Yearly Average of e-Journal Downloads Per Publisher)

SN	Organizations	Mean and CV	Elsevier	Springer Link	Taylor and Francis (T & F)	Emerald	John Wiley (Inter-Science)	Black well	Cambridge University Press (CUP)	American Institute of Aeronautics and Astronautics (AIAA)	Oxford University Press (OUP)
1	ADA	Mean	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		CV	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

2	ISRO-ISTRAC	Mean	570.00	2.50	0.00	0.00	0.00	0.00	0.00	6.75	0.00
		CV	74.56	200.00	0.00	0.00	0.00	0.00	0.00	116.89	0.00
3	IISc	Mean	0.00	19355.25	0.00	2800.00	0.00	0.00	0.00	0.00	0.00
		CV	0.00	156.36	0.00	120.44	0.00	0.00	0.00	0.00	0.00
4	JNCASR	Mean	2901.50	0.00	43.50	0.00	432.75	46.25	100.00	0.00	137.25
		CV	81.60	0.00	157.42	0.00	55.56	138.67	66.96	0.00	82.79
5	NAL	Mean	24909.25	1850.75	147.75	0.00	2117.50	0.00	211.50	0.00	37.25
		CV	87.94	107.57	200.00	0.00	97.13	0.00	86.94	0.00	200.00
Total Mean Scores of e-Journal Downloads Per Year / Per Publisher		Mean	5676.15	4241.70	38.25	560.00	510.05	9.25	62.30	1.35	34.90
		CV	233.22	338.28	350.58	315.22	230.87	343.54	186.38	309.93	219.91
P Values			0.011	0.234	0.493	0.067	0.022	0.134	0.013	0.057	0.024
Cumulative e-Journal Downloads for the Period (2005-2008)			113523.00	84834.00	765.00	11200.00	10201.00	185.00	1246.00	27.00	698.00

Table 2 : Contd..

SN	Organizations	Mean and CV	American Society of Mechanical Engineers (ASME)	American Society of Civil Engineers (ASCE)	American Mathematical Society (AMS)	American Chemical Society (ACS)	Elsevier – Science Direct	American Institute of Physics (AIP)	Indian National Science Academy (INSA)	Indian Academy of Sciences (IAS)
1	ADA	Mean	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		CV	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	ISRO-ISTRAC	Mean	55.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		CV	125.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	IISc	Mean	4069.25	1279.75	0.00	0.00	222069.50	0.00	0.00	0.00
		CV	147.68	151.92	0.00	0.00	115.75	0.00	0.00	0.00
4	JNCASR	Mean	0.00	0.00	0.00	0.00	39.25	29.25	0.00	0.00
		CV	0.00	0.00	0.00	0.00	200.00	200.00	0.00	0.00
5	NAL	Mean	985.00	45.50	0.00	299.33	0.00	1405.00	0.00	0.00
		CV	72.68	200.00	0.00	78.19	0.00	94.04	0.00	0.00
Total Mean Scores of e-Journal Downloads Per Year / Per Publisher		Mean	1021.85	265.05	0.00	47.26	44421.75	286.85	0.00	0.00
		CV	283.22	351.80	0.00	289.06	308.15	271.23	0.00	0.00
P Values			0.207	0.202	0.000	0.002	0.054	0.014	0.000	0.000
Cumulative e-Journal Downloads for the Period (2005-2008)			20437.00	5301.00	0.00	898.00	888435.00	5737.00	0.00	0.00

Table 2 : Contd..

SN	Organizations	Mean and CV	Royal Society of Chemistry (RSC)	Royal Society of London (RSL)	Web of Science	IEEE	Journals (Individual Titles)		
							Journal of Atmospheric Sciences	Air Force – Airman	Aircraft Engineering and Aerospace Technologies
1	ADA	Mean	0.00	0.00	0.00	104.75	0.00	0.00	0.00
		CV	0.00	0.00	0.00	125.94	0.00	0.00	0.00
2	ISRO-ISTRAC	Mean	0.00	0.00	0.00	0.00	0.00	0.00	2.75
		CV	0.00	0.00	0.00	0.00	0.00	0.00	68.72
3	IISc	Mean	0.00	0.00	131917.25	0.00	0.00	0.00	0.00
		CV	0.00	0.00	115.66	0.00	0.00	0.00	0.00
4	JNCASR	Mean	0.00	112.75	0.00	0.00	0.00	0.00	0.00
		CV	0.00	55.71	0.00	0.00	0.00	0.00	0.00
5	NAL	Mean	169.50	40.50	0.00	0.00	0.00	0.00	0.00
		CV	138.23	117.58	0.00	0.00	0.00	0.00	0.00
Total Mean Scores of e-Journal Downloads Per Year / Per Publisher		Mean	33.90	30.65	43972.42	20.95	0.00	0.00	0.55
		CV	342.83	179.11	233.79	323.57	0.00	0.00	247.27
P Values			0.132	0.001	0.403	0.085	0.000	0.000	0.001
5	NAL	Mean	169.50	40.50	0.00	0.00	0.00	0.00	0.00
		CV	138.23	117.58	0.00	0.00	0.00	0.00	0.00
Total Mean Scores of e-Journal Downloads Per Year / Per Publisher		Mean	33.90	30.65	43972.42	20.95	0.00	0.00	0.55
		CV	342.83	179.11	233.79	323.57	0.00	0.00	247.27

P Values		0.132	0.001	0.403	0.085	0.000	0.000	0.001
Cumulative e-Journal Downloads for the Period (2005-2008)		678.00	613.00	527669.00	419.00	0.00	0.00	11.00

To Be Answered By Chief Librarian / Web Administrator / Network Administrator / Sc.In.Charge E-Journals Full-Text Download

Questionnaire

E-Journal: Web Log Analysis Or Transaction Log Analysis Of Full Text Journal Downloads

1. Amongst the following reputed publishers of international journals, what is the total number of full-text journal article download over the last 4 years with specific reference to Aerospace Research?

Number of Full-Text Downloads from these Publishers of Electronic Journals:	2005	2006	2007	2008
(1) Elsevier				
(2) Springer Link				
(3) Taylor and Francis (T&F)				
(4) Emerald				
(5) John Wiley (Inter-Science)				
(6) Blackwell				
(7) Cambridge University Press (CUP)				
(8) American Institute of Aeronautics and Astronautics (AIAA)				
(9) Oxford University Press (OUP)				
(10) American Society of Mechanical Engineers (ASME)				
(11) American Society of Civil Engineers (ASCE)				
(12) American Mathematical Society (AMS)				
(13) Elsevier – Science Direct				
(14) American Institute of Physics (AIP)				
(15) Indian National Science Academy (INSA)				
(16) Indian Academy of Sciences (IAS)				
(17) Royal Society of London (RSL)				
(18) IEEE				
JOURNALS (Individual Titles):				
(1) Journal of Atmospheric Sciences				
(2) Airforce – Airman				
(3) Aircraft Engineering and Aerospace Technologies				
Grand Total:				

2. What is the total number of downloaded full-text e-journals from January to December 2005?

Sl. No.	Publishers of Full Text E-Journals	YEAR 2005											
	MONTHS	J	F	M	A	M	J	J	A	S	O	N	D
(1)	Elsevier												
(2)	Springer Link												
(3)	Taylor and Francis (T&F)												
(4)	Emerald												
(5)	John Wiley (Inter-Science)												
(6)	Blackwell												
(7)	Cambridge University Press (CUP)												

(8)	American Institute of Aeronautics and Astronautics (AIAA)												
(9)	Oxford University Press (OUP)												
(10)	American Society of Mechanical Engineers (ASME)												
(11)	American Society of Civil Engineers (ASCE)												
(12)	American Mathematical Society (AMS)												
(13)	Elsevier – Science Direct												
(14)	American Institute of Physics (AIP)												
(15)	Indian National Science Academy (INSA)												
(16)	Indian Academy of Sciences (IAS)												
(17)	Royal Society of London (RSL)												
(18)	IEEE												
(19)	**JOURNALS (Individual Titles):**												
	(1) Journal of Atmospheric Sciences												
	(2) Airforce – Airman												
	(3) Aircraft Engineering and Aerospace Technologies												

3. What is the total number of downloaded full-text e-journals from January to December 2006?

Sl. No.	Publishers of Full Text E-Journals	YEAR 2006											
	MONTHS	J	F	M	A	M	J	J	A	S	O	N	D
(1)	Elsevier												
(2)	Springer Link												
(3)	Taylor and Francis (T&F)												
(4)	Emerald												
(5)	John Wiley (Inter-Science)												
(6)	Blackwell												
(7)	Cambridge University Press (CUP)												
(8)	American Institute of Aeronautics and Astronautics (AIAA)												
(9)	Oxford University Press (OUP)												
(10)	American Society of Mechanical Engineers (ASME)												
(11)	American Society of Civil Engineers (ASCE)												
(12)	American Mathematical Society (AMS)												

(13)	Elsevier – Science Direct												
(14)	American Institute of Physics (AIP)												
(15)	Indian National Science Academy (INSA)												
(16)	Indian Academy of Sciences (IAS)												
(17)	Royal Society of London (RSL)												
(18)	IEEE												
(19)	**JOURNALS (Individual Titles):** (1) Journal of Atmospheric Sciences (2) Airforce – Airman (3) Aircraft Engineering and Aerospace Technologies												

4. What is the total number of downloaded full-text e-journals from January to December 2007?

Sl. No.	Publishers of Full Text E-Journals	YEAR 2007											
	MONTHS	J	F	M	A	M	J	J	A	S	O	N	D
(1)	Elsevier												
(2)	Springer Link												
(3)	Taylor and Francis (T&F)												
(4)	Emerald												
(5)	John Wiley (Inter-Science)												
(6)	Blackwell												
(7)	Cambridge University Press (CUP)												
(8)	American Institute of Aeronautics and Astronautics (AIAA)												
(9)	Oxford University Press (OUP)												
(10)	American Society of Mechanical Engineers (ASME)												
(11)	American Society of Civil Engineers (ASCE)												
(12)	American Mathematical Society (AMS)												
(13)	Elsevier – Science Direct												
(14)	American Institute of Physics (AIP)												
(15)	Indian National Science Academy (INSA)												
(16)	Indian Academy of Sciences (IAS)												
(17)	Royal Society of London (RSL)												
(18)	IEEE												

(19)	JOURNALS (Individual Titles): (1) Journal of Atmospheric Sciences (2) Airforce – Airman (3) Aircraft Engineering and Aerospace Technologies												

5. What is the total number of downloaded full-text e-journals from January to December 2008?

Sl. No.	Publishers of Full Text E-Journals	YEAR 2008											
	MONTHS	J	F	M	A	M	J	J	A	S	O	N	D
(1)	Elsevier												
(2)	Springer Link												
(3)	Taylor and Francis (T&F)												
(4)	Emerald												
(5)	John Wiley (Inter-Science)												
(6)	Blackwell												
(7)	Cambridge University Press (CUP)												
(8)	American Institute of Aeronautics and Astronautics (AIAA)												
(9)	Oxford University Press (OUP)												
(10)	American Society of Mechanical Engineers (ASME)												
(11)	American Society of Civil Engineers (ASCE)												
(12)	American Mathematical Society (AMS)												
(13)	Elsevier – Science Direct												
(14)	American Institute of Physics (AIP)												
(15)	Indian National Science Academy (INSA)												
(16)	Indian Academy of Sciences (IAS)												
(17)	Royal Society of London (RSL)												
(18)	IEEE												
(19)	JOURNALS (Individual Titles): (1) Journal of Atmospheric Sciences (2) Airforce – Airman (3) Aircraft Engineering and Aerospace Technologies												

6. What is the most preferred file format of full-text download amongst the different aerospace journal publishers for the years 2005-2008?

P = Acrobat (.PDF format), W = MS-Word (.DOC format), H = HTML (.html format), O = Others.

Number of Full-Text Downloads from these Publishers of Electronic Journals:		2005				2006				2007				2008			
		P	W	H	O	P	W	H	O	P	W	H	O	P	W	H	O
(1)	Elsevier																
(2)	Springer Link																
(3)	Taylor and Francis (T&F)																
(4)	Emerald																
(5)	John Wiley (Inter-Science)																
(6)	Blackwell																
(7)	Cambridge University Press (CUP)																
(8)	American Institute of Aeronautics and Astronautics (AIAA)																
(9)	Oxford University Press (OUP)																
(10)	American Society of Mechanical Engineers (ASME)																
(11)	American Society of Civil Engineers (ASCE)																
(12)	American Mathematical Society (AMS)																
(13)	Elsevier – Science Direct																
(14)	American Institute of Physics (AIP)																
(15)	Indian National Science Academy (INSA)																
(16)	Indian Academy of Sciences (IAS)																
(17)	Royal Society of London (RSL)																
(18)	IEEE																
(19)	**JOURNALS (Individual Titles):** (1) Journal of Atmospheric Sciences																
	(2) Airforce – Airman																
	(3) Aircraft Engineering and Aerospace Technologies																