

Indian Aerospace Scientists and Engineers and their Strong Perceptions about Electronic Journals Access – A Research Survey

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Abstract-- With the coming of e-resources, there has been a significant transformation by which scholarly information is disseminated throughout the world. In fact, the arrival of e-journals has greatly affected the way a scientist or an engineer seeks this information, acquires it and then uses it effectively. The major conclusions of this study are: Analysis of Variance (ANOVA) was applied for testing the significant difference among the 16 mean scores attained from the scientists and engineers of the 16 selected aerospace organizations of Bangalore, INDIA, for 'Strong Perceptions about e-Journals Access'. It is observed that all the 16 aerospace organizations show a significant difference ($P < 0.05$) in their mean scores viz., 'More User-Friendly than Printed Journals', 'More Frequently Used than Printed Journals', 'Enhances Access / Visibility to Scientific Papers', 'Decreases Time Spend on Articles Search or Visiting the Library', 'Increases the Scholarly Productivity in Terms of Publishing Papers', 'Keeps Current about Global R&D', 'Distribution of Articles Easier and Less Costly', 'Features like Editorial News, Links to Other Papers, Peer Reviews, Alerts are Useful', 'Listing Articles Under Hot-Articles/Most Viewed Articles etc. are Useful' and 'Increases the Number of Papers read which are Outside the Primary Discipline' except for 'Decreases the Quality / Rigor of Research Literature ($P=0.070$)' and 'Increases Over-Exposure to Non-Peer Reviewed Papers'.

Keywords: Electronic Journals, Strong Perceptions, Indian Aerospace Scientists and Engineers, Research Survey.

I. INTRODUCTION

Today, scientists and engineers use electronic resources because of quick, easy access, and convenience. Also, very little effort is required to retrieve information from these e-resources. It is very clear that the World Wide Web has very largely facilitated and propelled the emergence of these electronic resources. Several studies on conducted on Scientists have revealed that that 'electronic journals' are highly important to their work, more than any other information resources, **Tenopir (2001)**.

Knowledge production in the Aerospace industry is paramount: The Aerospace sector is highly R&D intensive and levels of competition are high. More competition acts an innovation driver in Aerospace. Aerospace is dominated by Strategic innovators, firms which drive innovation performance in the sector directly but also indirectly as they are the source of many innovative products and processes that are adopted by other firms throughout their domestic economy and internationally. **Hollanders (2008)**.

It is absolutely clear that the use of electronic media to support scientific communication has undoubtedly been one of the paradigm shifts in the practice of science in this era. For a research scientist today, with access to the Internet, working across continents and in different time zones and keeping in touch with his peers has indeed become a reality due to the exponential growth of the telecommunication infrastructure that the world has witnessed. Most surprisingly, all this happens with very marginal costs of communication.

A research survey was conducted to find out the 'Strong Perceptions about e-Journal Access among the Aerospace Scientists and Bangalore. The present study is restricted to the selected 16 prominent aerospace organizations in 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.

II. THE ELECTRONIC JOURNALS AND THE CHANGING PATTERNS OF USE

It is absolutely clear that traditional print journals, even those available electronically are slowly changing. There is a paradigm shift in their usage and they are moving towards electronic formats. Many studies have revealed that the electronic versions of papers are being read about as often as the printed journal versions. The growth rates in usage of electronic information resources are sufficiently high and if this trend continues for a few more years, a time may come soon when the print versions will get 'totally eclipsed'. The coming of the World Wide Web has propelled this vigorous growth of the

electronic forms of communication which simply do not fit into the traditional publishing format. With the coming of age of the electronic journals, it has totally altered the way scholarly information is disseminated throughout the world. There is no doubt that this particular innovation has changed the information usage of scientists. Invariably, the role of the librarian has dramatically changed to meet the 'vibrant electronic needs' of the scientists and engineers. Electronic journals has greatly affected not only the way information has spread, but also the way in which electronic information acquired and how scientists, engineers, scholars and researchers seek this needed information.

III. CSIR-NATIONAL AEROSPACE LABORATORIES

NAL is a constituent Institution under the Council of Scientific and Industrial Research of India. NAL is a high technology oriented institution concentrating on advanced topics in the aerospace and related disciplines. Among the aerospace organizations of Bangalore, NAL occupies a very special place. NAL is India's premier civil aviation R&D aerospace organization in the country. Originally started as National Aeronautical Laboratory, it was renamed National Its main Mandate and Mission are: (a) Development of aerospace technologies with a strong science content and with a view to their practical application to the design and construction of flight vehicles, (b) NAL is also required to use its aerospace technology base for general industrial applications. NAL is the harbinger of civil aviation design and development activities in India. In a nutshell, 'Technology' would be NAL's core engine for the future. NAL will make special efforts to identify, develop and market spin-off technologies. NAL is also required to use is aerospace technology base for general industrial applications. NAL is the harbinger of civil aviation design and development activities in India. 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. ROLE CSIR-NAL IN PROMOTING E-RESOURCES USAGE AMONGST ITS SCIENTISTS AND ENGINEERS AND TECHNOLOGISTS AS PART OF THE CSIR-NISCAIR-DST-NKRC CONSORTIA

Today, every NAL scientist has access to online electronic scholarly information right at their desktops. This has been possible with the help of setting up of the 'The National Knowledge Resource Consortium (NKRC) jointly established by CSIR and DST with the 'National Institute of Science Communication and Information Resources (NISCAIR), a sister CSIR Laboratories as its apex body. With the setting up of the 'National Knowledge Resource Consortium', it has been possible for every NAL scientist and engineer to access almost 5,000+ e-journals by typing up with almost 23 reputed international journal publishers. This facility enables any CSIR scientist to access, browse, search and download 'full-text' journal articles from any computer system connected to the campus wide network. This clearly indicates that 'Electronic Information Resources', more so e-Journals are extremely important to an aerospace scientist or engineer to keep pace with global R&D. The names of various e-Publishers covered under this NKRC is given in Figure 1 below.



FIGURE -1: LIST OF PUBLISHERS UNDER THE NKRC UMBRELLA

V. REVIEW OF LITERATURE

Tenopir et al., (2002), opines in her study that Studies from 1977 through 2001 demonstrate that scientists continue to read widely from scholarly journals. Reading of scholarly articles has increased to approximately 120-130 articles per person per year, with engineers reading fewer journal articles on the average and medical faculty reading more. A growing proportion of these readings come from e-prints and other separate copies. Most scientists in a discipline now use electronic journals at least part of the time, with considerable variations among disciplines. Evidence suggests that scientists are reading from a broader range of journals than in the past, influenced by timely electronic publishing and by growth in bibliographic searching and interpersonal communication as means of identifying and locating articles.

Tenopir et al., (2009), highlights in their study that average number of readings per year per science faculty member continues to increase, while the average time spent per reading is decreasing. Electronic articles now account for the majority of readings, though most readings are still printed on paper for final reading. Scientists report reading a higher proportion of older articles from a wider range of journal titles and more articles from library e-collections. Articles are read for many purposes and readings are valuable to those purposes.

King et al., (2003), The authors in their study point out that University libraries are rapidly moving toward electronic journal collections. Readership surveys at three universities with different levels of electronic journal implementation demonstrate how transition to electronic journal collections affects use patterns of faculty and staff. Three popular Universities were taken as the sample population, namely: (a) The University of Tennessee, (b) The University of Pittsburgh, (c) Drexel University. The study also revealed that electronic journal use is very high when available in library collections. Also, Scientists appear to be more advanced in their use of electronic journals than other faculty, but changes are taking place within all faculty disciplines.

Tenopir et al., (2001), in their article mention that studies over three decades conducted by them show that information in journals serves many purposes (research, teaching, current awareness, background reading, etc.) for scientists in both university and non-university settings. These scientists report that journal articles are highly important to their work, more so than any other information resource. Medical scientists rely on journals much more on the average than other scientists, engineers less. The convenience of desktop access to journal articles allows all scientists to read more, from a wider variety of sources, although there is an upper limit on the time they can devote to reading. Finally, the information that scientists get from refereed journals results in improved performance, as evidenced by the awards and accomplishments of scientists who read more.

Tenopir et al., (2004), in their paper mention that medical faculty read a great deal, especially compared to scientists. The most frequently reported principal purpose of reading is to support their primary research (30% of reading). The majority of reading comes from recently published articles, mostly from personal subscriptions. Medical faculty read more articles than others on average and need information digested and verified in a way to save them time. Convenience and currency are highly valued attributes.

VI. OBJECTIVES OF THE STUDY

- To determine the frequency of 'Strong Perceptions about e-Journals Access' among the aerospace scientists and engineers of Bangalore
- To ascertain whether the percentage of preference of the 'Frequency of 'Strong Perceptions about e-Journals Access' by the aerospace engineers and scientists are approximately the same.
- To study whether there exists similar patterns (homogeneous) of 'Strong Perceptions about e-Journals Access' among the aerospace scientists and engineers Bangalore.

VII. NULL HYPOTHESES

- There is no significant difference in the mean scores of 'Strong Perceptions about e- Journals Access' among the aerospace scientists and engineers of Bangalore.

VIII. MATERIALS AND METHODS

The present study is restricted to the selected 16 prominent aerospace organizations in 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**. The investigator also divided the whole population of the study into two major categories: namely, aerospace scientists and engineers. It may be seen from **Table 2**, that out of 583 respondents, 295 (50.6%) are aerospace scientists and the remaining 288(49.4%) are aerospace engineers. The 'Strong Perceptions about e-Journals Access' is illustrated in **Table 3(a,b)**, with the necessary statistical inferences. Random sampling technique has been used for selection of the sample size.

IX. RESULTS AND DISCUSSION

SUMMARY OF TOTAL SCORES FOR THE FREQUENCY OF USAGE OF WEB SITES

- The summary of total mean scores obtained with regard to the strong perceptions about access to e-Journals is as follows. The highest total mean score of 2.67(CV=44.96) is obtained for the option 'Keeps Current about Global R&D'. This is followed by the mean score of 2.65(CV=45.73) for the option 'Distribution of Articles Easier and Less Costly'. This is followed by the mean score of 2.59(CV=45.35) for the option 'More Frequently Used than Printed Journals'. Coming up next with a mean score of 2.57(CV=46.64) goes for the option 'Enhances Access / Visibility to Scientific Papers'. This is followed by the mean score of 2.56(CV=46.37) for the option 'Features like Editorial News, Links to Other Papers, Peer Reviews, Alerts are Useful'. The option 'Decreases Time Spent on Articles Search or Visiting the Library' generates the next highest mean score of 2.53(CV=50.73). This is followed by the next highest mean score of 2.49(CV=52.52) which is taken up for the option 'More User Friendly than Printed Journals'. A mean score of 2.45(CV=48.88) is represented by the option 'Listing Articles under Hot Articles/ Most-Viewed Articles etc. are Useful'. The next highest mean score of 2.40(CV=49.55) is taken up for the option 'Increases the Number of Papers read which are Outside the Primary Discipline'. This is followed by a mean score of 2.35(CV=51.66) which is represented for 'Increases the Scholarly Productivity in Terms of Publishing Papers'. The next highest mean score of 2.24(CV=51.87) goes for the option 'Increases Over-Exposure to Non-Peer Reviewed Papers'. Finally, the lowest mean score of 2.14(CV=57.98) is depicted for the option 'Decreases the Quality / Rigor of Research Literature'.
- Analysis of Variance (ANOVA) was applied for testing the significant difference among the 16 mean scores attained from the scientists and engineers of the aerospace organizations for 'Strong Perceptions about e-Journals Access'. It is observed that all the 16 aerospace organizations show a significant difference ($P < 0.05$) in their mean scores viz., 'More User-Friendly than Printed Journals', 'More Frequently Used than Printed Journals', 'Enhances Access / Visibility to Scientific Papers', 'Decreases Time Spent on Articles Search or Visiting the Library', 'Increases the Scholarly Productivity in Terms of Publishing Papers', 'Keeps Current about Global R&D', 'Distribution of Articles Easier and Less Costly', 'Features like Editorial News, Links to Other Papers, Peer Reviews, Alerts are Useful', 'Listing Articles Under Hot-Articles/Most Viewed Articles etc. are Useful' and 'Increases the Number of Papers read which are Outside the Primary Discipline' **except for 'Decreases the Quality / Rigor of Research Literature (P=0.070)' and 'Increases Over-Exposure to Non-Peer Reviewed Papers'**.

X. CONCLUSIONS

THE MAIN CONCLUSIONS THAT WE WOULD LIKE HIGHLIGHT IN THIS STUDY ARE:

- Analysis of Variance (ANOVA) was applied for testing the significant difference among the 16 mean scores attained from the scientists and engineers of the aerospace organizations for 'Strong Perceptions about e-Journals Access'. It is observed that all the 16 aerospace organizations show a significant difference ($P < 0.05$) in their mean scores viz., 'More User-Friendly than Printed Journals', 'More Frequently Used than Printed Journals', 'Enhances Access/Visibility to Scientific Papers', 'Decreases Time Spent on Articles Search or Visiting the Library', 'Increases the Scholarly Productivity in Terms of Publishing Papers', 'Keeps Current about Global R&D', 'Distribution of Articles Easier and Less Costly', 'Features like Editorial News, Links to Other Papers, Peer Reviews, Alerts are Useful', 'Listing Articles Under Hot-Articles/Most Viewed Articles etc. are Useful' and 'Increases the Number of Papers read which are Outside the Primary Discipline' **except for 'Decreases the Quality / Rigor of Research Literature (P=0.070)' and 'Increases Over-Exposure to Non-Peer Reviewed Papers'**.
- This also implies that, the percentage of preference of the 'Strong Perceptions about e-Journals Access' by the aerospace engineers and scientists are not approximately the same, **except for 'Decreases the Quality/ Rigor of Research Literature (P=0.070)' and 'Increases Over-Exposure to Non-Peer Reviewed Papers'**.
- The study also reveals that there is heterogeneity in the Use Patterns of 'Strong Perceptions of e-Journals Access', **except for 'Decreases the Quality / Rigor of Research Literature (P=0.070)' and 'Increases Over-Exposure to Non-Peer Reviewed Papers' among the aerospace scientists and engineers of Bangalore.**

XI. ACKNOWLEDGMENTS

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TABLES AND FIGURES

Table-1: Distribution of Source Data (Sample Size)

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 Study (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: Profile of the Respondents (Category-Wise Distribution)

Sl. No.	Organizations	Categories		Organization Wise, Total No. of Respondents	% of Total Sample
		Aerospace Scientist	Aerospace Engineer		
1	ADA	39	19	58	9.9
2	AFTC	0	15	15	2.6
3	ADE	12	0	12	2.1
4	ASTE	2	27	29	5.0
5	CABS	13	1	14	2.4
6	CEMILAC	26	3	29	5.0
7	C-MMACS	2	4	6	1.0
8	DARE	7	2	9	1.5
9	LRDE	2	0	2	0.3
10	GTRE	12	9	21	3.6
11	HAL	3	131	134	23.0
12	IAM	30	3	33	5.7
13	ISRO-ISTRAC	5	17	22	3.8
14	IISc	21	13	34	5.8
15	JNCASR	1	0	1	0.2
16	NAL	120	44	164	28.1
Total for all Organizations		295	288	583	
Percent for all Organizations		(50.6)	(49.4)	(100.0)	100.0
Chi-Square		278.811			
P Value		0.000			

(Numbers in brackets indicate percentages)

Table – 3a: What are your strong perceptions about access to e-journals? Please (✓) one option

4 – Strongly agree, 3 – Agree, 2 – Uncertain, 1 – Disagree, 0 – Strongly disagree						
(1)	More user-friendly than printed journals	4	3	2	1	0
(2)	More frequently used than printed journals	4	3	2	1	0
(3)	Enhances access / visibility to scientific papers	4	3	2	1	0
(4)	Decreases the quality / rigor of research literature	4	3	2	1	0
(5)	Decreases time spent on article search or visiting the library	4	3	2	1	0
(6)	Increases the scholarly productivity in terms of publishing papers	4	3	2	1	0
(7)	Increases over-exposure to non-peer reviewed papers	4	3	2	1	0
(8)	Keeps current about global R&D	4	3	2	1	0
(9)	Distribution of articles easier and less costly	4	3	2	1	0
(10)	Features like editorial news, links to other papers, peer reviews, alerts are useful	4	3	2	1	0
(11)	Listing articles under hot-articles/most-viewed articles etc. are useful	4	3	2	1	0
(12)	Increases the number of papers read which are outside the primary discipline	4	3	2	1	0

Table-3b: User's Strong Perceptions about e-Journals

Sl. No.	Organizations	Mean and CV	Strong Perceptions: e-Journal											
			More user-friendly than printed journals	More frequently used than printed journals	Enhances access / visibility to scientific papers	Decreases the quality / rigor of research literature	Decreases time spent on articles search or visiting the library	Increases the scholarly productivity in terms of publishing papers	Increases over-exposure to non-peer reviewed papers	Keeps current about Global R&D	Distribution of articles easier and less costly	Features like editorial news, links to other papers, peer reviews, alerts are useful	Listing articles under hot-articles/ most-viewed articles etc. are useful	Increase the number of papers read which are outside the primary discipline
1	ADA	Mean	2.64	2.52	2.55	2.34	2.69	2.41	2.36	2.83	2.71	2.52	2.57	2.71
		CV	44.17	48.36	44.76	53.32	42.48	47.23	47.38	39.27	42.66	46.02	45.60	39.15
2	AFTC	Mean	1.93	1.80	1.67	1.60	1.40	1.33	1.40	1.73	1.93	1.60	1.33	1.53
		CV	71.74	63.69	77.46	77.63	84.52	88.14	88.72	73.84	76.89	84.52	88.14	81.26
3	ADE	Mean	1.58	3.00	2.92	2.58	2.67	3.00	2.50	2.75	2.75	3.00	2.83	2.92
		CV	91.16	24.62	27.19	45.08	48.85	28.43	43.48	38.37	27.41	24.62	25.33	22.92
4	ASTE	Mean	2.76	2.62	2.55	2.24	2.55	2.34	2.24	2.83	2.79	2.48	2.38	2.59
		CV	37.09	38.72	37.16	50.10	42.66	44.55	50.10	43.39	43.20	48.88	45.51	40.71
5	CABS	Mean	1.93	2.21	2.43	2.29	2.64	2.50	2.29	2.57	2.36	2.07	2.36	2.14
		CV	77.35	56.51	50.34	55.42	50.56	46.41	49.82	42.37	48.82	51.73	45.90	51.31
6	CEMILAC	Mean	1.45	1.69	1.59	2.07	1.79	1.79	1.83	1.93	1.93	1.69	1.76	1.93
		CV	98.66	91.01	93.08	63.19	83.49	77.99	82.81	76.97	81.80	95.04	85.50	79.42
7	C-MMACS	Mean	3.33	3.17	3.33	2.50	3.17	2.83	2.67	3.33	3.17	3.33	3.00	2.83
		CV	15.49	23.77	15.49	33.47	23.77	41.26	65.67	15.49	23.77	15.49	36.51	46.91
8	DARE	Mean	2.89	3.11	2.67	2.78	2.22	2.56	2.67	2.67	3.00	3.00	2.89	2.67
		CV	43.94	25.13	26.52	46.86	58.58	48.37	41.93	18.75	16.67	16.67	36.49	32.48
9	LRDE	Mean	3.50	3.50	4.00	2.00	3.50	2.50	2.50	3.00	3.50	3.50	2.00	2.50
		CV	20.20	20.20	0.00	0.00	20.20	28.28	28.28	0.00	20.20	20.20	0.00	28.28
10	GTRE	Mean	3.19	2.90	2.76	1.95	3.05	2.62	2.57	3.10	2.86	3.00	2.76	2.57
		CV	25.50	30.61	25.36	52.42	19.35	35.15	36.00	17.41	35.50	21.08	30.09	36.00
11	HAL	Mean	2.19	2.30	2.31	1.96	2.32	2.22	2.13	2.41	2.34	2.37	2.34	2.27
		CV	63.60	54.68	54.55	64.45	57.78	58.78	57.39	55.55	56.53	53.76	53.91	58.01
12	IAM	Mean	2.30	2.21	2.45	2.09	2.30	2.09	2.33	2.58	2.42	2.42	2.21	2.18
		CV	54.80	51.49	49.99	60.22	52.61	57.79	51.01	44.51	43.79	41.29	51.49	46.48
13	ISRO-ISTRAC	Mean	3.05	2.95	2.86	2.09	3.27	2.55	2.32	3.18	3.14	3.00	2.91	2.55
		CV	32.80	30.41	37.79	60.69	30.09	52.47	53.89	30.11	34.50	34.12	35.04	48.08
14	IISc	Mean	3.21	3.29	3.32	1.56	3.18	2.82	2.47	3.26	3.44	3.18	2.82	3.03
		CV	38.23	31.29	32.05	85.33	37.55	42.24	36.25	30.45	22.84	30.48	40.40	30.93
15	JNCASR	Mean	4.00	4.00	0.00	3.00	3.00	2.00	3.00	4.00	3.00	3.00	3.00	2.00
		CV	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
16	NAL	Mean	2.62	2.85	2.81	2.30	2.57	2.42	2.23	2.74	2.81	2.71	2.52	2.36
		CV	45.09	34.34	38.72	51.85	49.66	46.89	48.02	40.63	39.32	39.95	45.49	48.76
Mean Scores Obtained for Strong Perceptions Access to e-Journals		Mean	2.49	2.59	2.57	2.14	2.53	2.35	2.24	2.67	2.65	2.56	2.45	2.40
		CV	52.52	45.35	46.64	57.98	50.73	51.66	51.87	44.96	45.73	46.37	48.88	49.55
P Values			0.000	0.000	0.000	0.070	0.000	0.005	0.176	0.000	0.000	0.000	0.001	0.002