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# Scientometric Analysis of Recent Aeronautical Research: A Study

**S.Santhanakarthikeyan[*] , Dr. P.Padma[**], M.Grace[1], D.Ravikrishnan[***]**

[*] *Librarian and Information Officer, Anna Centenary Library, Chennai.*

[**] *Assistant Professor, DOLIS, Maduraj Kamaraj University, Madurai.*

[***]. *Librarian and Information Assistant, Anna Centenary Library, Chennai.*

## 1. INTRODUCTION

The economic and strategic importance of aeronautical research makes it one of the most critical areas of research around the globe. We explore this area by using the keyword aeronautical in IEEE explore database. IEEE explore is an extensive database that includes conference papers and magazine. Our objective in this paper is to analyse international aeronautical research during 2003–2012. We aim to uncover recent trends in research, the emergence of new countries and institutions in aeronautical research. During this period 2003 to 2012, the IEEE explores 86 publications in aeronautical research.

## 2. LITERATURE REVIEW

Aerospace science and technology is a major research area for nations because of its economic and strategic importance. A study done by Gupta, B.M. (2002) to find out the research publications in science and technology in India during the period 1995-1999. In India, the priority areas of research, as reflected in distribution of papers are chemistry, physics, biomedical research, clinical medicine, and engineering and technology. The publications output from 1986-88 to 1995-97 increased from 25.7% to 27.3% in chemistry, 16.2% to 20.2% in physics, and 10.8% to 11.1% in engineering &technology. The 26 co-authored papers in Engineering & Technology are scattered across 8 sub-disciplines. The research was predominately bilateral in aerospace technology, metals & metallurgy, material science, computers and mechanical engineering and multilateral in civil engineering.

Gangan Pratap analysed aerospace research in India using the scopus database. The analysis of publications conducted to identify the top countries doing the research. In that, Singapore ranks first and Israel ranks second while India ranks 25th. USA accounts for about 44% world's publications in aerospace and china are second with about 12% of publications.

There is a strong contribution from Asian institution in Aerospace research during recent years. However only two Indian institutions make it into the list i.e. the IIT and IISc. IISc published 28% of Indian research work followed by NAL with about 20% and four IITs together total about 37% of the papers in the country.

## 3. OBJECTIVES OF THE STUDY

Objectives of the study are to determine the following:

- To identify the language wise distribution of the literature
- To uncover Authorship patterns
- To describe Geographical distribution
- To list out Reference count
- To analyse Distribution of citations
- To identify Highly cited articles
- To identify Most prolific author
- To analyse Distribution of publication

## 4. METHODOLOGY

The present study adopts a descriptive research approach by means of bibliometric analysis, because of its nature as an exploratory investigation to describe the quantity, characteristics, and productivity of global publication in the field of Aeronautical engineering. The present study is limited to Aeronautical articles indexed in IEEE database Citation Index produced by the Institute of Electrical and Electronics Engineering.

The basis of IEEE products is the bibliographical descriptions of articles and their references from academic journals in various subject areas. Also, the materials published in aeronautical journals in IEEE come form every nation in the world. Researchers form around the world chooses to publish their research in this database. At the time of our study (2003 - 2012), the IEEE database listed a total of 86 aeronautical unique title journals. At the time this study was conducted, the IEEE database contained about 86 contributions during the period 2003 - 2012. At an early stage of the analysis, bibliographic data of each article was collected.

## 5. FINDINGS OF THE STUDY

### 5.1. *Language distribution of articles*

For each 86 articles the publication language were surveyed. After analysis of the articles, it was observed that 100 percent of the articles were in English. This may be because of the source journals are in English.

**Table 1.: Authorship pattern**

| Sl. No. | Authorship | No(s). | Percentage |
|---|---|---|---|
| 1 | Single Author | 6 | 7.1% |
| 2 | Two Authors | 21 | 24.7% |
| 3 | Three Authors | 31 | 36.5% |
| 4 | Four Authors | 16 | 18.8% |
| 5 | Five Authors | 7 | 8.2% |
| 6 | Six Authors | 2 | 2.4% |
| 7 | Seven Authors | 1 | 1.2% |

**Figure 1.: Authorship pattern**

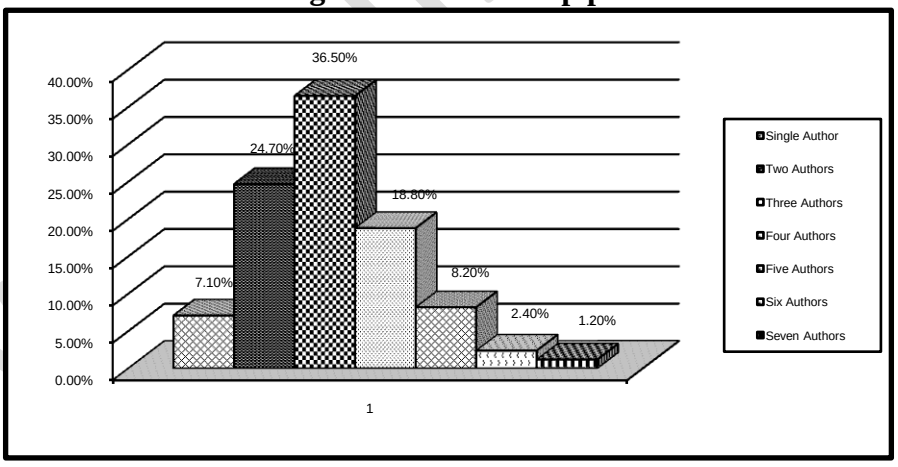


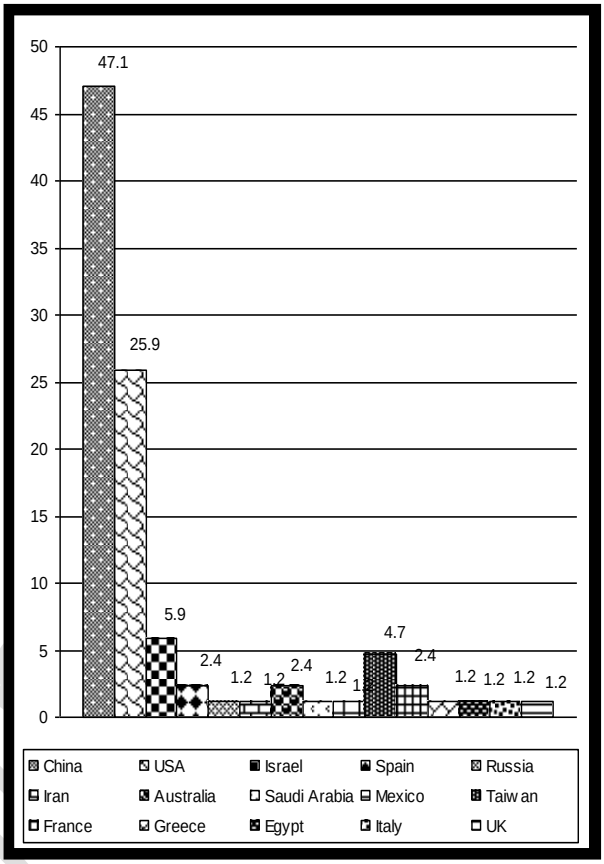

Table 1 shows that out of 86 articles, 6 (7.1%) articles were single authored, 21 (24.7%) were two authored and 31 (36.5%) were three authored. Remaining other articles has been contributed by more than four authors. In this analysis, most of the articles (36.5%) are contributed by three authors.

### 5.2. *Geographical distribution*

**Table 2.:** ***Geographical distribution***

| Sl. No. | Country | No. of Articles | Percentage |
|---|---|---|---|
| 1 | China | 40 | 47.1% |
| 2 | USA | 22 | 25.9% |
| 3 | Israel | 5 | 5.9% |
| 4 | Spain | 2 | 2.4% |
| 5 | Russia | 1 | 1.2% |
| 6 | Iran | 1 | 1.2% |
| 7 | Australia | 2 | 2.4% |
| 8 | Saudi Arabia | 1 | 1.2% |
| 9 | Mexico | 1 | 1.2% |
| 10 | Taiwan | 4 | 4.7% |
| 11 | France | 2 | 2.4% |
| 12 | Greece | 1 | 1.2% |
| 13 | Egypt | 1 | 1.2% |
| 14 | Italy | 1 | 1.2% |
| 15 | UK | 1 | 1.2% |

**Figure 2.:** ***Geographical distribution***




It was feasible to analyse the articles under sample according to geographical distribution. The needed data were collected from the address field of the authors. Table 2 shows the geographical distribution of published articles in 86 articles. Out of 86 articles, the highest number i.e. 40 (47.1%) has been contributed by China professionals that is followed with approximately 25.9% by USA authors. During the study period the sample articles were produced by 15 countries. These countries have been categorized in three groups on their portion participant. China and USA, Isreal are in group one, and can be called as Pioneers in aeronautical. The second group with four countries including: Taiwan, Spain and Australia and France are the fast followers. The third groups of 8 countries are the up comer countries.

The third groups with 20countries are the Beginners, and other countries in the world may be called Laggards in publishing articles on journals covered by ISI. As the table indicates about 62% of the articles are produced by two countries, 4.3% by 3 countries, 10% by 8 countries 8.34% by 12 countries and just 3.74% by 20 countries. It should be noted that article and journal coverage of the IEEE explore database differs from country to country.

**Table 3.: Year-wise Reference count for the articles**

| Sl. No. | Year | Reference Count | Percentage |
|---|---|---|---|
| 1 | 2003 | 3 | 0.6% |
| 2 | 2004 | 25 | 4.7% |
| 3 | 2005 | 57 | 10.7% |
| 4 | 2006 | 46 | 8.6% |
| 5 | 2007 | **0** | **0.0**% |
| 6 | 2008 | 41 | 7.7% |
| 7 | 2009 | 34 | 6.4% |
| 8 | 2010 | 35 | 6.6% |
| 9 | 2011 | 92 | 17.3% |
| 10 | 2012 | **199** | **37.4**% |

### 5.3. *Reference distribution*

References play a very important role in scientific literature. They not only vouch for the authority and relevance of the statements that are called upon to support but they also embed the work reported in context of previous research. As a whole, the average number of references in the sample articles is 22 references per article. A paper that contains no references to previous research may be an indication that the research is a new contribution or review of literature has not been done. References also contribute to the intricacy of a paper.

The frequency distribution of references per articles showed that out of 86 articles, no references were made for the articles in the year 2007. The maximum references 199 (37.4%) made in the year 2012. Nearly 34.7% of the articles were having references between 10–50 while 28% of the articles have references above 50 references.

**Table 4.: Year-wise citation count for the articles**

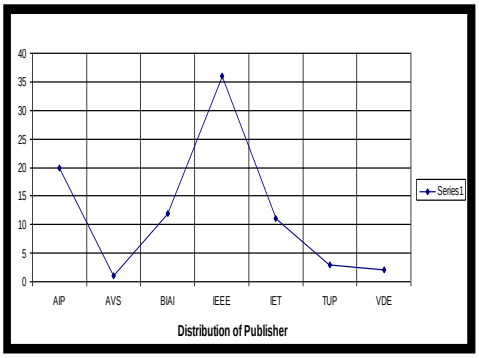
| Sl. No. | Year | Citation Count | Percentage |
|---|---|---|---|
| 1 | 2003 | 0 | 0.0% |
| 2 | 2004 | 6 | 25.0% |
| 3 | 2005 | 4 | 16.7% |
| 4 | 2006 | 6 | 25.0% |
| 5 | 2007 | 6 | 25.0% |
| 7 | 2008 | 1 | 4.2% |
| 6 | 2009 | 0 | 0.0% |
| 7 | 2010 | 0 | 0.0% |
| 8 | 2011 | 0 | 0.0% |
| 9 | 2012 | 1 | 4.2% |

**5.4.** ***Distribution of citations***

Data from the table 4, A total of 24 citations, including self-citations, were collected from the sample articles during the years 2003 to 2012. The collected data indicates that out of 894 articles, 458 (51.23%) articles were cited and 436 (48.77%) were not cited, but the differences does not seem remarkable. It indicates that out of 458 cited articles those with one citations has the highest number (182; about 40%) and other 60 percent has got citations between 2 to more than 10 times. The average number of citations for 458 cited articles is 3.14, but as a whole for all cited and not cited articles is 1.60 per article.

***Table 5.: Distribution of Publication***

| Sl. No. | Publisher | No. of Articles | Percentage |
|---|---|---|---|
| 1 | AIP | 20 | 23.3% |
| 2 | AVS | 1 | 1.2% |
| 3 | BIAI | 12 | 14.0% |
| 4 | IEEE | 36 | 41.9% |
| 5 | IET | 11 | 12.8% |
| 6 | TUP | 3 | 3.5% |
| 7 | VDE | 2 | 2.3% |



From the data collected, it shows that most of the articles (41.9%) are published by IEEE and 23.3% of the articles are published in AIP journals, 14% of the articles are from BIAI. Other than this, the articles from AVS, IET, TUP and VDE are also indexed in IEEE databases regarding aeronautical research.

**Table 5.: List of highly cited articles during the period 2003 – 2012**

| Sl. No. | Title | Author | Year | Citation count |
|---|---|---|---|---|
| 1. | Thermal loading of laser induced plasma shockwaves on thin films in nanoparticle removal | Cetinkaya, Cetin; Peri, M. D. Murthy;Varghese, Ivin;Zhou, Dong | 2007 | 3 |
| 2. | Rotational motion of microsphere packs on acoustically excited surfaces | Cetinkaya, Cetin; Peri, M. D. Murthy | 2005 | 3 |
| 3. | Molecular-level mechanisms of nanoparticle detachment in laser-induced plasma shock waves | Cetinkaya, Cetin; Zhou, Dong | 2006 | 2 |
| 4. | Self-managing systems: a control theory foundation | Hellerstein, J.L | 2004 | 2 |
| 5. | Multi-timescale fuzzy controller for a continuum with a moving oscillator | Lin, J. | 2004 | 2 |
| 6. | Multiobjective Evolutionary Algorithms in Aeronautical and Aerospace Engineering | Arias-Montano, A.;Coello, C.A.C.; Mezura-Montes, E. | 2012 | 1 |
| 7. | Semantic Interoperability Integrating and Augmenting Legacy Applications with OWL Ontologies | Holmes, D.; Stocking, R. | 2008 | 1 |
| 8. | Air-coupled excitation of rocking motion of individual microspheres on surfaces | Cetinkaya, Cetin; Murthy Peri, M. D. | 2007 | 1 |
| 9. | Underwater pressure amplification of laser-induced plasma shock waves for particle removal applications | Cetinkaya, Cetin; Dunbar, Thomas J. | 2007 | 1 |

| | | | | |
|---|---|---|---|---|
| 10. | Air-coupled acoustic method for testing and evaluation of microscale structures | Cetinkaya, Cetin_2;Ricci, Justin | 2007 | 1 |
| 11. | Regular perturbation solution of the Elenbaas-Heller equation | Shaw, B. D. | 2006 | 1 |
| 12. | New algorithm for infrared small target image enhancement based on wavelet transform and human visual properties | Songtao, Liu; Xiaodong, Zhou; Xuewei, Wang | 2006 | 1 |
| 13. | Robust H<inf>âˆž</inf> control for uncertain descriptor systems with state and control delay | Fengxian, Piao; Qingling, Zhang; Xiuzhen, Ma | 2006 | 1 |
| 14. | A novel low-profile, dual-band, dual-polarization broadband array antenna for 2G/3G base station | Hongxing Wang; Houming Zhou; Jidong Xie; Shanhong He; Xiguo Liu | 2006 | 1 |
| 15. | Maxwell Slip Model Based Identification and Control of Systems with Friction | Fassois, S.D.;Rizos, D.D. | 2005 | 1 |
| 16. | Analysis of linear weighted order statistics CFAR algorithm | Jian, Guan; Xiangwei, Meng; You, He | 2004 | 1 |
| 17. | Enabling optimisation in the design of complex computer based systems | Denford, M.; Leaney, J.; O'Neill, T. | 2004 | 1 |

These 13 titles are arranged according to their decreasing order of the number of citations. A total of 17 cited articles, 16 articles were published in journals and 8 articles were published in conference proceedings. Among the cited articles (17), most of the articles (6) were produced by the author "Cetinkaya, Cetin" who were producing one article in the year 2005 and 2006 each, 4 articles in the year 2007.

These highly cited papers involved contribution from mechanical and aeronautical engineering department(6 papers), IBM Thomas J. Watson Research Center (1), New York, Department of Electronic Engineering (2 papers) and Automatic Control Engineering Dept (Naval Aeronautical Engineering Institute, China) (1 paper), Inst. of System Science (1

papers), and Dept. of computer science, Mexico (1), Dept. of Mechanical engineering, electrical engineering and production engineering departments (1 paper each).

## 6. CONCLUDING REMARKS

The above data clearly reveals that economic position of a country is not necessarily a barrier in taking an active role in terms of research and publication the manner in which china toping the table of publications should bare testimony to this true. Given that it is appropriate to ask: ? what can other emerging economies like India do in strengthening aeronautic research. The first step in planting seeds of research interest among students is to make various resources such as databases, books, and other aeronautical literature easily available, secondly emerging countries should make and effort to collaborate with leading countries and sufficient financial aid should be allocated so that countries like India can create a land mark in this field.

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