

ISSN 2320-2548

INTERNATIONAL JOURNAL OF INFORMATION RETRIEVAL AND MANAGEMENT

Volume 1, Issue 1, (January - June) 2013



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Printed at Sri Guptha Printing Works, Salem. Phone : 0427 - 2254522

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MAPPING OF HIGHLY CITED PAPERS IN GREEN COMPUTING RESEARCH

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Abstract

This article presents a citation-based mapping such as co-author network map and citation map of data on global scientific activities in the field of Green Computing research using Scopus and Web of Science Databases. Using different scientometric approaches, a continuous increase of both quantitative and qualitative parameters such as h-index, g-index, citation scores. Research papers published in the field of Green Computing by the researchers during 1956-2011 and that have been cited at least 100 times by end of 2012 are analysed. Prominent authors have been able to place their papers in high impact journals such as Journal of Statistical Physics, Journal of High Energy Physics and Science. The study reveals that the output of Green Computing research has gradually increased over the years.

Key words : Mapping, Green Computing, India, Web of Science.

1. INTRODUCTION

As an emerging topic in IT management, "Green IT" practices are drawing high interest among IT organizations as well as suppliers, manufacturers and service providers. With the rapid run up of energy costs and a broadening awareness of the impact of global climate change, IT organizations are looking for strategies to offset rising costs and use technology in ways that reduce their environmental impact. By keeping this view in mind, the researcher intends to undertake the study on "Mapping the Research Productivity of Green Computing: A Scientometric Study". This study attempts to analyse the performance of researcher working in the field of Green Computing in terms of growth rate, areas of research concentration, authorship pattern, scattering of articles in different sources, institution wise distribution and so on.

2. OBJECTIVES

- ❑ To determine the authorship pattern and the nature of collaboration and co-authorship pattern.

- ❑ To identify the authors and Institutions wise h-index, g-index and gh-index.
- ❑ To identify the highly cited papers with Citation Map in the field of Green Computing.
- ❑ To visualize the co-author Network Map.

3. METHODOLOGY

The required data was collected from Web of Science database for the period 1956-2011. It can be seen that nearly 3324 bibliographic records of contribution in field of Green Computing over the period of 56 years. The researcher applied the search strings "Green Computing or Green IT" that has used for the data extraction from the database of SCI, SSCI and A&HCI (totally fifty six years) to download the records based on the above strings. A total of 3324 records were downloaded and analyzed by using Web of Science and Scopus inbuilt software applications as per the objectives of the study. Further based on citation per paper with Citation map, number of high quality papers, are also applied to find out the quality of the research output. The study aims to analyze the

thrust areas of research concentration on Green Computing research.

4. AUTHORSHIP PATTERN

The author of "Cederbaum LS" from Italy has produced 34 articles with 696 TCS and its h-index value is 15, g-index value is 25, gh-index value is 19 and CPP value is 19.18 and 41 times cited the mentioned authors' articles. The author of "Tadeu A" from Portugal has produced 23 articles with 75 TCS and its h-index value is 5, g-index value is 9, gh-index value is 7 and CPP value is 3.26 and only 2 times cited the mentioned authors' articles. "Tarantelli F" from Italy has produced 20 articles with 495 TCS and its h-index value is 12, g-index value is 21, gh-index value is 16 and CPP value is 22.7 and only 38 times cited the mentioned authors' articles. "Uzunoglu NK" from Greece has produced 15 articles with 187 TCS and its h-index value is 7, g-index value is 10, gh-index value is 8 and CPP value is 6.13 and only 2 times cited the mentioned authors' articles. "Kumar R" from India has produced 14 articles with 27 TCS and its h-index value is 3, g-index value is 5, gh-index value is 4 and CPP value is 1.93 and there is no cited articles. "Pozrikidis C" from USA

has produced 14 articles with 218 TCS and its h-index value is 9, g-index value is 15, gh-index value is 12 and CPP value is 15.36 and only 4 times cited the mentioned authors' articles. "Bard PY" from France has produced 12 articles with 170 TCS and its h-index value is 7, g-index value is 13, gh-index value is 9 and CPP value is 14.17 and only 16 times cited the mentioned authors' articles. "Sanchez-Sesma FJ" from Mexico has produced 12 articles with 80 TCS and its h-index value is 5, g-index value is 9, gh-index value is 7 and CPP value is 6.67 and only 14 times cited the mentioned authors' articles. "Antonio J" from Portugal has produced 11 articles with 32 TCS and its h-index value is 4, g-index value is 5, gh-index value is 4 and CPP value is 2.91 and only one time cited the mentioned authors' articles. "Godinho L" from Portugal has produced 11 articles with 41 TCS and its h-index value is 4, g-index value is 6, gh-index value is 8 and CPP value is 3.73 and that one time cited the mentioned authors' articles. It is concluded from this analysis that the author of "Cederbaum LS" (Italy) is identified as the active author of Green Computing publications; the scored high values for h-index, g-index, gh-index and CPP values and number of cited the articles.

Table 1 : Shows h- index values and g - index

S.No.	Author	Country	Recs.	TCS	h index	g index	gh - index	CPP	TLCR
1	Cederbaum LS	Italy	34	696	15	25	19	19.18	41
2	Tadeu A	Portugal	23	75	5	9	7	3.26	2
3	Tarantelli F	Italy	20	495	12	21	16	22.7	38
4	Uzunoglu NK	Greece	15	187	7	10	8	6.13	2
5	Kumar R	India	14	27	3	5	4	1.93	0
6	Pozrikidis C	USA	14	218	9	15	12	15.36	4
7	Bard PY	France	12	170	7	13	9	14.17	16
8	Sanchez-Sesma FJ	Mexico	12	80	5	9	7	6.67	14
9	Antonio J	Portugal	11	32	4	5	4	2.91	1
10	Godinho L	Portugal	11	41	4	6	8	3.73	1

4.1 Co-Author Network

The number of co-authors displayed is limited to the top 30 only; there may be other co-authors of Cederbaum, L.S. and the network of co-authors is presented below. Darker colors indicate more articles co-authored.

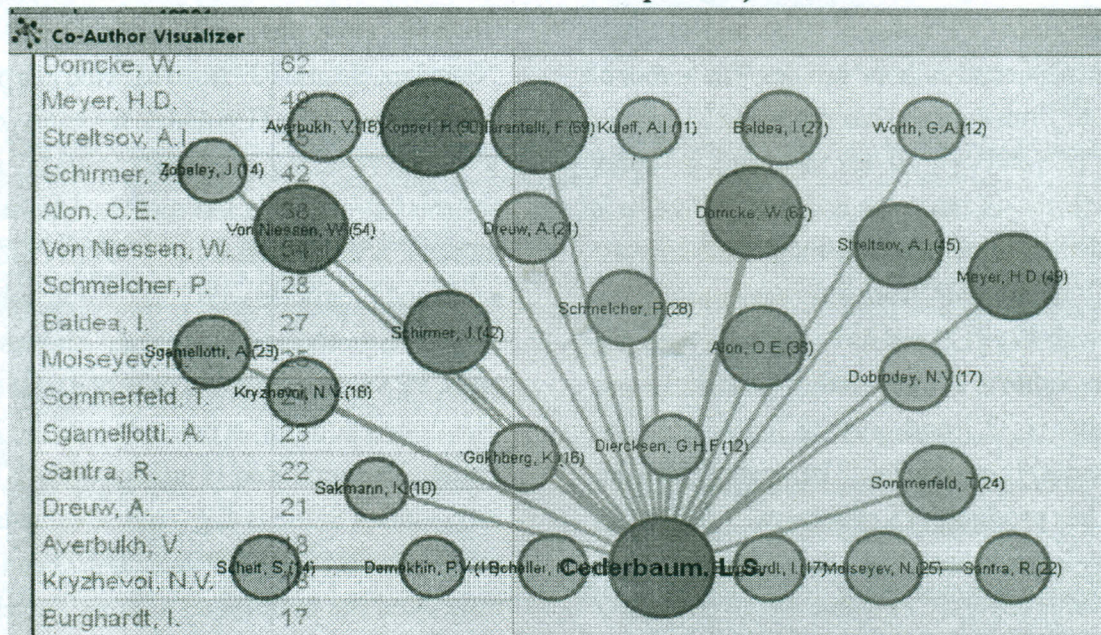


Figure 1 : Shows Co-author Visualizer of Cederbaum LS

4.3 Co-Author Visualizer of Dadeu A

Out of the total 3324 number of publications, author Dadeu is high in number 23 and

4.2 Co-Author Visualizer of Cederbaum LS

Out of the total 3324 number of publications, author Cederbaum LS is high in number 34 and Global citation Scores 652 and more over he has published more than 600 papers in other discipline too (Source: Web of Science and Scopus 605) .

Global citation Scores 75 and more over he has published more than 110 papers in other discipline also (Source: Web of Science and Scopus 132) .

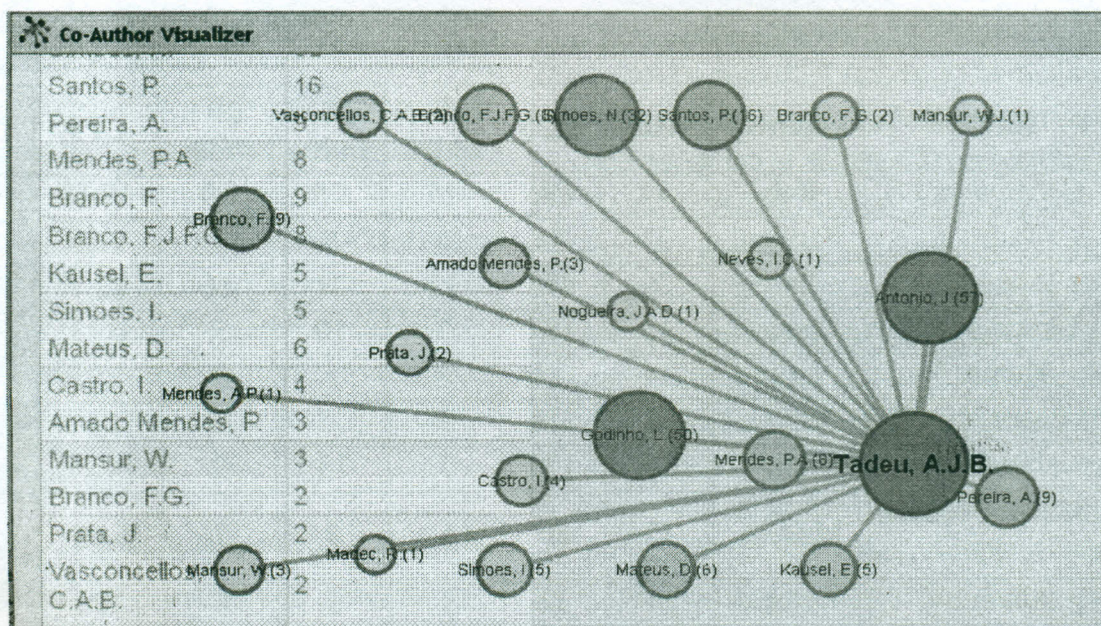


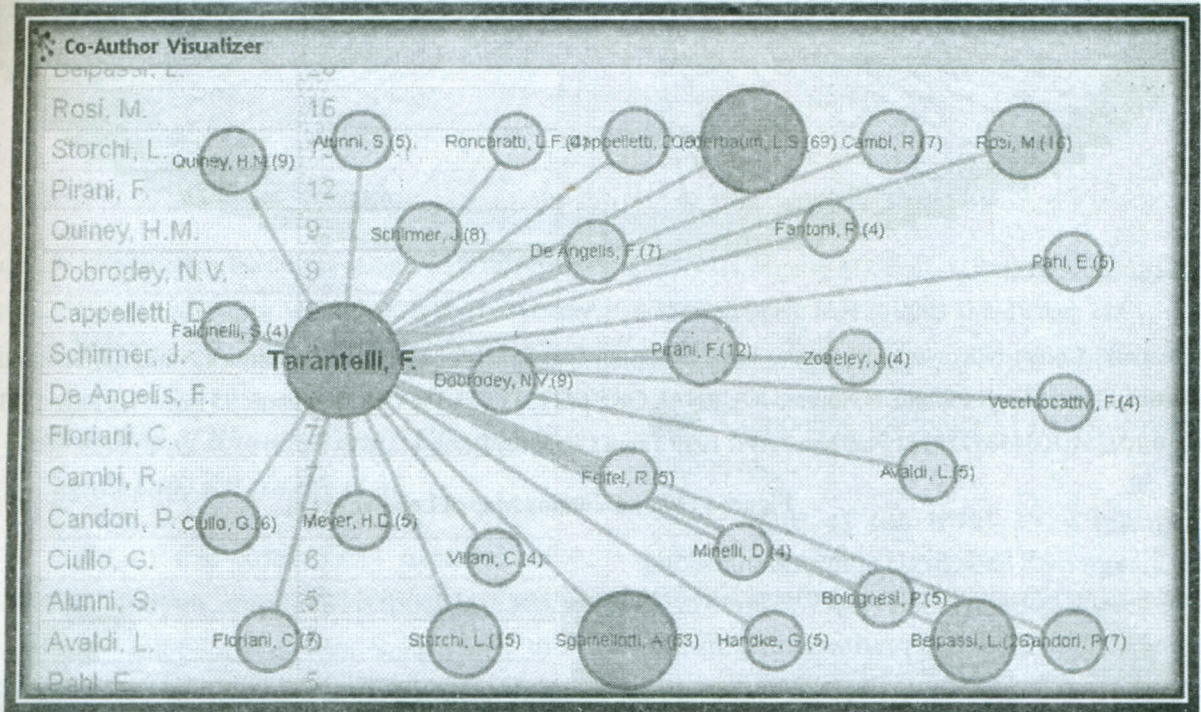
Figure 2 : Shows Co-author Visualizer of Dadeu A

4.4 Co-Author Visualizer of Tarantelli F

Out of the total 3324 number of publications, author Tarantelli F is high with number 20 and Global citation Scores is 454 in the

field of Green Computing and more over he has published more than 120 papers in other disciplines (Source: Web of Science and Scopus 144).

Figure 3 : Shows Co-author Visualizer of Tarantelli F



4.5 Citation Map of Highly Cited Authors

A Citation Map is a graphical representation that shows the citation relationships (cited references and citing articles) between a paper and other papers using various visualization tools and techniques. Citation mapping analysis can be applied as subject similarity indicators. It is defined as "the frequencies with two documents are cited together". (Source: Web of Science Database)

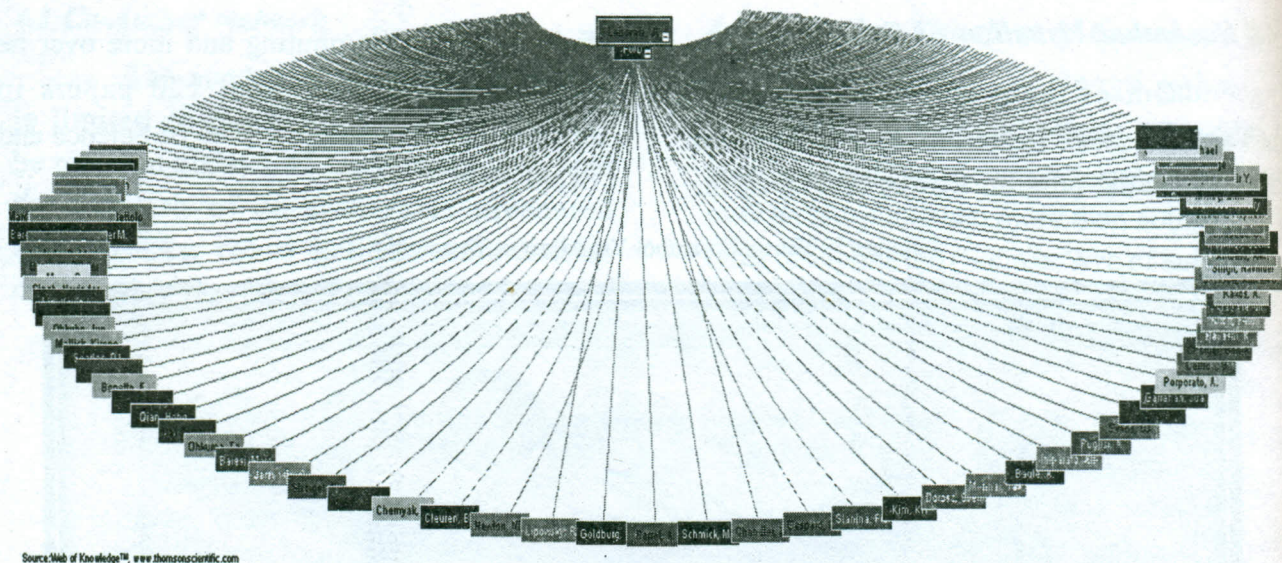
4.6 Citation Map of Lebowitz et al., and DT Son and AO Starinets

Out of the total 3324 number of publications, author leborwitz, JL is much less with number 2 but Global citation Scores are 454 and single paper has received 407 citations. The average citation per article of Leborwitz is 227 in the field

of Green Computing and below figure 4.9 shows the citation map.

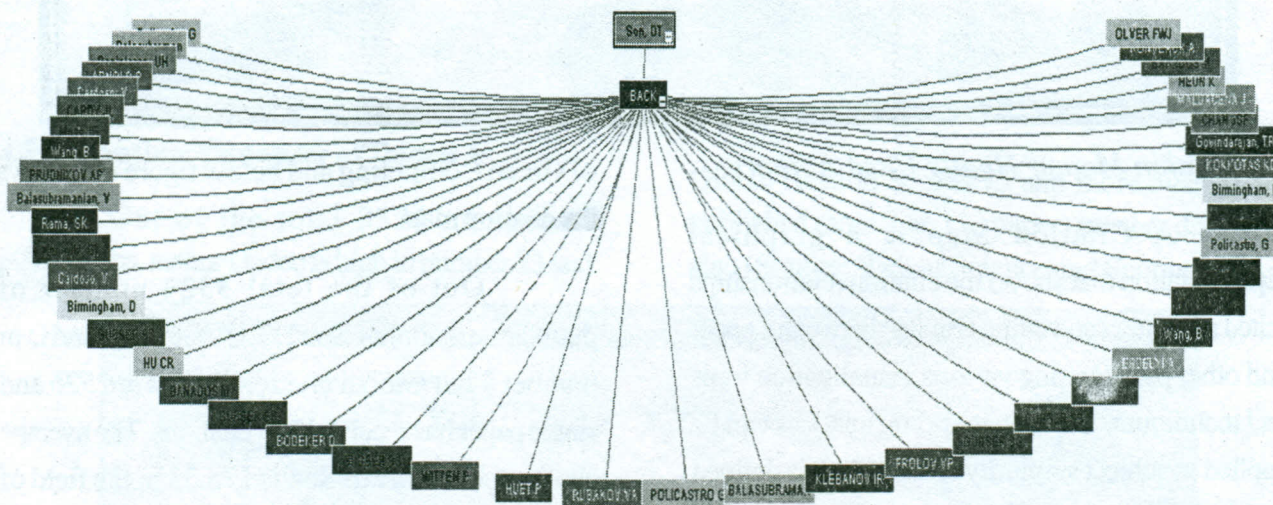
Out of the total 3324 number of publications, author Son DT is much less and is in number 3 but Global citation Scores are 526 and single paper has received 313 citations. The average citation per article of Son is 175.33 in the field of Green Computing and the figure 4.10 below shows that citation map.

(A Gallavotti-Cohen-type symmetry in the large deviation functional for stochastic dynamics
Author(s):Lebowitz, JL (Lebowitz, JL); Spohn, H (Spohn, H)Source: JOURNAL OF STATISTICAL PHYSICS Volume: 95 Issue: 1-2 Pages: 333-365 DOI: 10.1023/A:1004589714161 Published: APR 1999 Times Cited: 407)



(A Gallavotti-Cohen-type symmetry in the large deviation functional for stochastic dynamics Author(s):Lebowitz, JL (Lebowitz, JL); Spohn, H (Spohn, H)Source: JOURNAL OF STATISTICAL PHYSICS Volume: 95 Issue: 1-2 Pages: 333-365 DOI: 10.1023/A:1004589714161 Published: APR 1999 Times Cited: 407)

Figure 4 : Shows Citation Map of Lebowitz et al.,



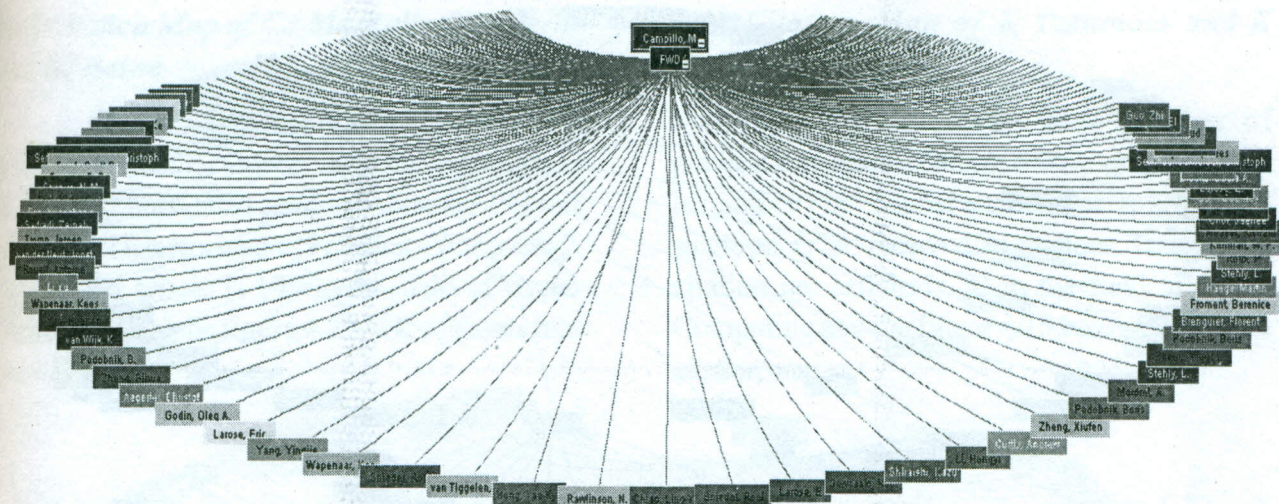
Minkowski-space correlators in AdS/CFT correspondence: recipe and applications Author(s):Son, DT (Son, DT); Starinets, AO (Starinets, AO) Source: JOURNAL OF HIGH ENERGY PHYSICS Issue: 9 Article Number: 042 DOI: 10.1088/1126-6708/2002/09/042 Published: SEP 2002 Times Cited: 313

Figure 5 : Shows Citation Map of DT Son and AO Starinets

4.7 Citation Map of M. Campillo and A Paul

Out of the total 3324 number of publications, author Campillo M is much less and is in number 9 but Global citation Scores are 583

and single paper has received 247 citations. The average citation per article is 64.78 in the field of Green Computing and the below figure 4.11 shows that citation map.



Long-range correlations in the diffuse seismic coda Author(s):Campillo, M (Campillo, M); Paul, A (Paul, A)Source: SCIENCE
Volume: 299 Issue: 5606 Pages: 547-549 DOI: 10.1126/science.1078551 Published: JAN 24 2003 Times Cited: 247

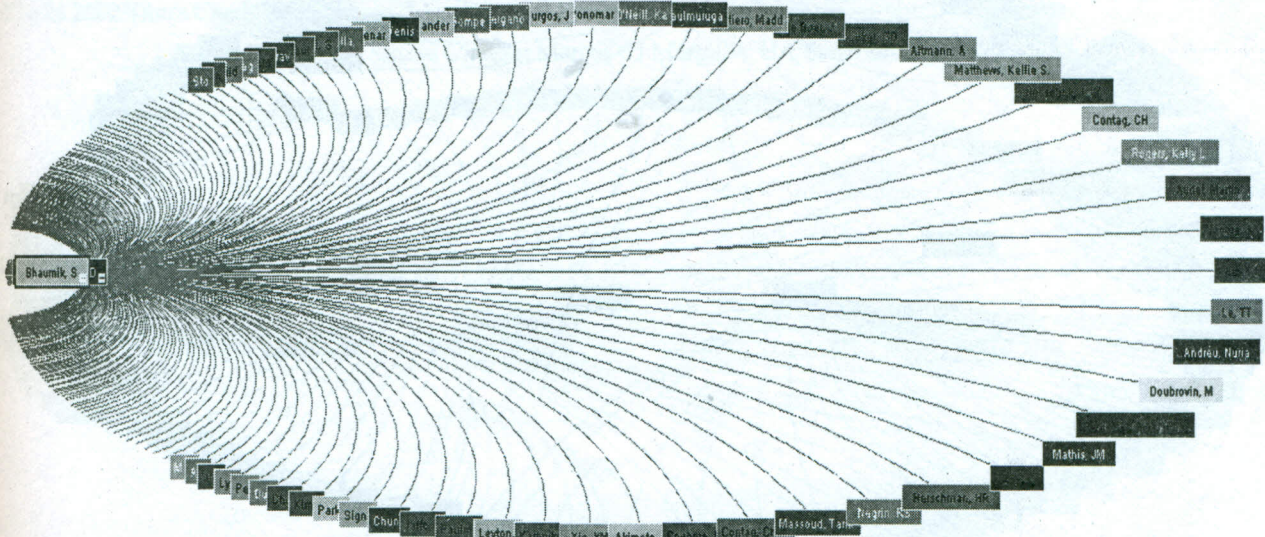
Figure 6 : Shows Citation Map of M. Campillo and A Paul

4.8 Citation Map of Bhaumik and S SGambhir & PS Thenkabail, RB Smith et al.

Out of the total 3324 number of publications, author Campillo M is much less and is in number 1 but Global citation Scores are 239 and single paper has received 239 citations. The average citation per article is 239 in the field of

Green Computing and figure 4.12 below shows that citation map.

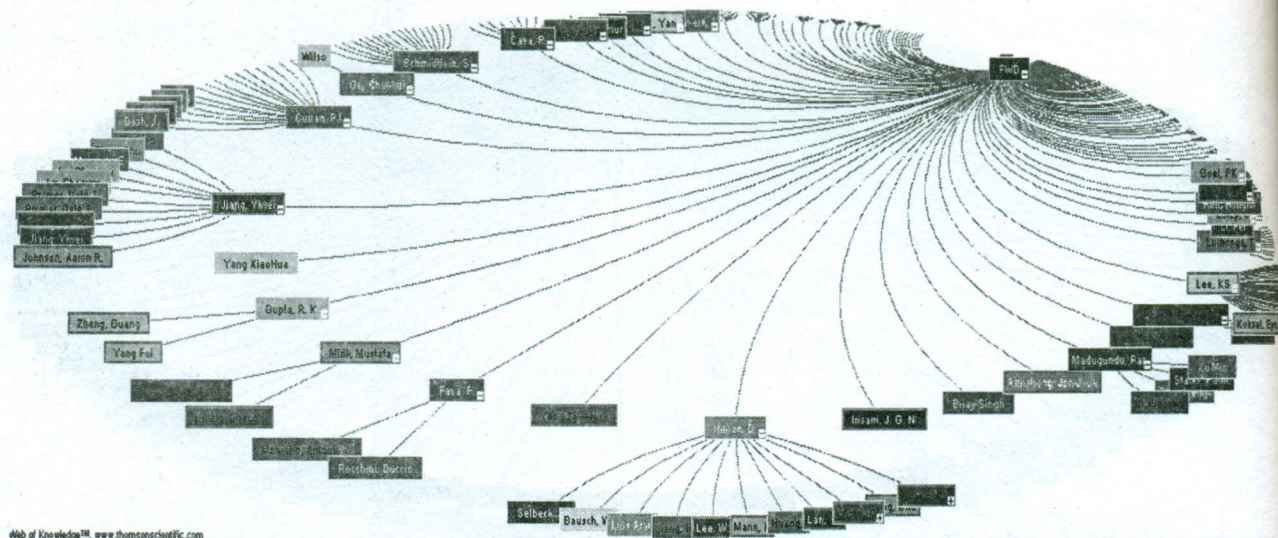
Out of the total 3324 number of publications, author Thenkabail PS is much less and is in number 2 but Global citation Scores are 277 and single paper has received 234 citations. The average citation per article is 138.5 in the field of Green Computing and the figure 4.13 below shows that citation map.



Source: Web of Knowledge™, www.thomsonscientific.com

Optical imaging of Renilla luciferase reporter gene expression in living mice Author(s):Bhaumik, S (Bhaumik, S); Gambhir, SS (Gambhir, SS) Source: PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE UNITED STATES OF AMERICA Volume: 99 Issue: 1 Pages: 377-382 DOI: 10.1073/pnas.012611099 Published: JAN 8 2002 Times Cited: 239

Figure 7 : Shows Citation Map of Bhaumik and S SGambhir



Web of Knowledge™, www.thomsonscientific.com

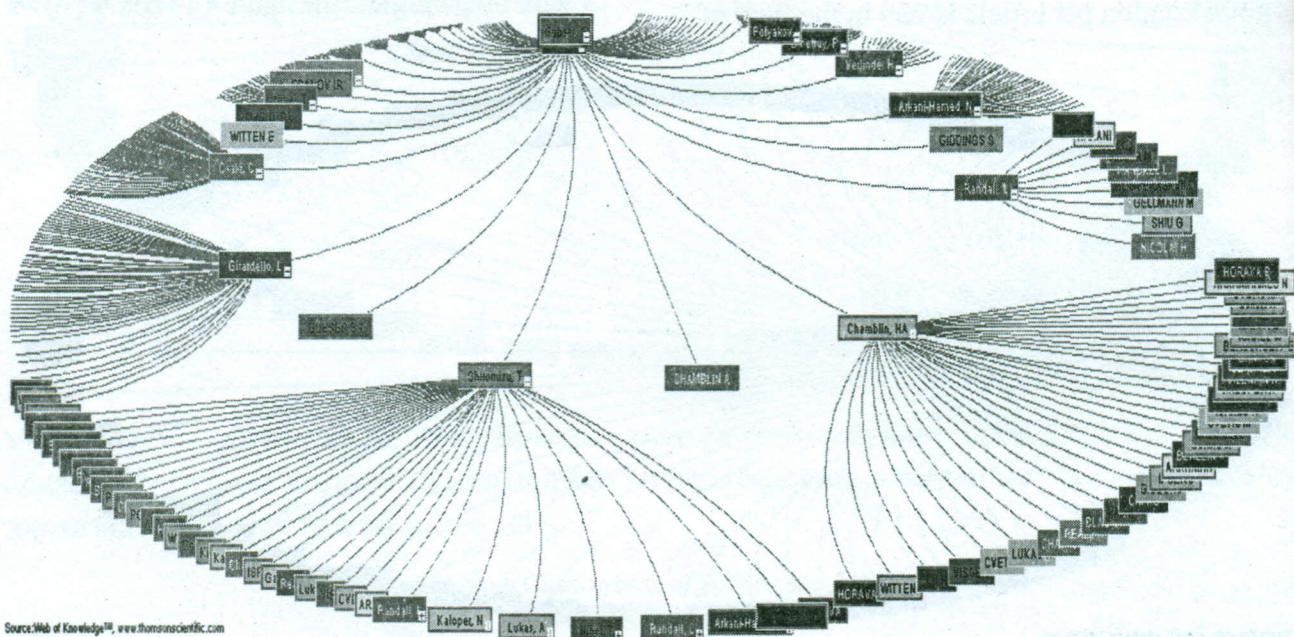
Hyperspectral vegetation indices and their relationships with agricultural crop characteristics Author(s): Thenkabail, PS (Thenkabail, PS); Smith, RB (Smith, RB); De Pauw, E (De Pauw, E) Source: REMOTE SENSING OF ENVIRONMENT Volume: 71 Issue: 2 Pages: 158-182 DOI: 10.1016/S0034-4257(99)00067-X Published: FEB 2000 Times Cited: 234

Figure 8 : Shows Citation Map of PS Thenkabail, RB Smith and E De Pauw

4.9 Citation Map of SS Gubser

Out of the total 3324 number of publications, author Gubser SS is much less in number 2 but Global citation Scores 242 and

single paper received 214 citations. The average citation per article is 121 in the field of Green Computing and the figure 4.14 below shows that citation map.



Source: Web of Knowledge™, www.thomsonscientific.com

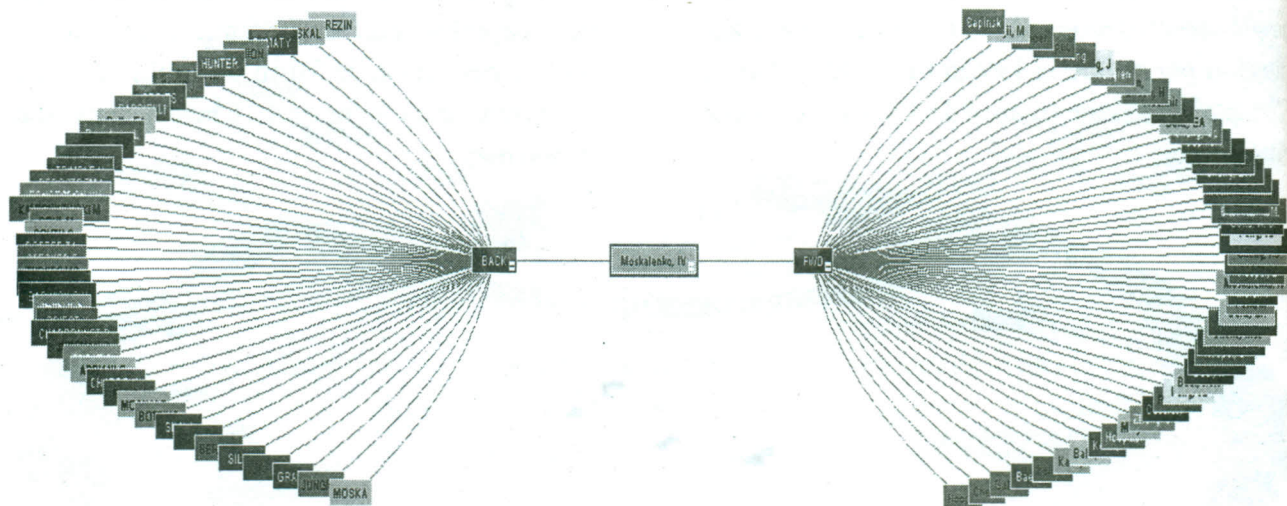
AdS/CFT and gravity Author(s): Gubser, SS (Gubser, SS) Source: PHYSICAL REVIEW D Volume: 63 Issue: 8 Article Number: 084017 DOI: 10.1103/PhysRevD.63.084017 Published: APR 15 2001 Times Cited: 214

Figure 9 : Shows Citation Map of SS Gubser

4.12 Citation Map of Moskalenko IV

Out of the total 3324 number of publications, author Gubser SS is much less and is in number 1 but Global citation are Scores 55 and

single paper has received 55 citations. The average citation per article is 55 in the field of Green Computing and the figure 4.17 below shows that citation map.



Positrons from particle dark-matter annihilation in the Galactic halo: Propagation Green's functions Author(s):Moskalenko, IV (Moskalenko, IV); Strong, AW (Strong, AW) Source: PHYSICAL REVIEW D Volume: 60 Issue: 6 Article Number: 063003 DOI: 10.1103/PhysRevD.60.063003 Published: SEP 15 1999 Times Cited:55

Figure 4.12 – Shows Citation Map of Moskalenko IV

5. FINDINGS AND CONCLUSION

Based on the analysis undertaken the present study reveals the following findings:

- ❑ Total number of publications is 3324 and 44640 times cited by others scientist, its average citation value is 13.43. The overall years h – index value is 80.
- ❑ Out of 3324 articles, the Indian authors contributing in the area of Green Computing is just 128 (3.9 %) articles. The researcher has found that the publication variation does not differs much from that to the period between the years of 1991 to 2011, very less number of publications as shown in the table. Indeed, it is below 20 articles. The overall period average citation value is 5.49 measured from 128 articles from Indian authors output of Green Computing.

- ❑ The group of citing papers includes a large number of highly cited papers we would describe as citation classics. The sum of the times cited is 44640, Average Citations per time is 13.43 and h-index is 80.

The highest publications are in years of 2010 and 2007 with Global Citation Scores and triennial growth rate is the highest in between 1991 to 2011. The whole study period records the mean relative growth rate of 0.16 and the doubling time for publications at the aggregate level has been computed as 0.29 years. The highest growth rate is during 2010. The overall years h – index value is 80. The author of “Cederbaum LS” (Italy) is identified the active author of Green Computing publications; he scored high values for h-index, g-index, gh – index and cpp values and number of cited articles. Single authored work is less than that of the multiple authored contributions. It means that the collaborative authors' contribution is very high.

Hence, single author contributions have to be encouraged and this will certainly help for more publications. Since India is known for its advancement in Information and Communication Technology an impetus should be given for more publications by single author and multiple authors. Overall, at the global level single author publications should be encouraged.

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