

Publications Analysis of Energy Efficient Healthcare from SCOPUS Database: A Study

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***Abstract** - Healthcare is a field of research which improves the life time of human being. Day by day a lot of research is growing in this field. One of the main applications of Wireless Sensor Networks (WSN) is Healthcare. Body Sensor Network (BSN) is a type of WSN which is useful for patient monitoring. Because the sensor nodes are battery powered, energy is one of the main constraint takes to consider. So an energy efficient healthcare should be enabled. This study aims to analyze the Publications using the keywords Energy Efficient and Healthcare and the data for analysis is collected from the SCOPUS database. The growth rate of the publications regarding these keywords is analyzed. The publication data are collected for the years 2008 to 2018 which includes totally 60 publications in English language with different document types. This study analyzes the Source type of the publications, annual growth rate, Relative growth rate, Doubling time, keywords which is frequently occurred, Subject areas, and authors who published maximum publications in this area.*

Keywords: Relative Growth Rate, Doubling Time, Healthcare, Energy Efficient, BSN Introduction

This study analyze the data collected from SCOPUS database using the keywords energy efficient and Healthcare in terms of the number of publications published every year in this field, their relative growth rate and doubling time. This analysis is done for 11 years from 2008 to 2018. The different source types and document types used in these publications are also analyzed. Moreover the different affiliations (90 countries) and 164 authors which support these publications are analyzed.

Review of Literature

Healthcare is a budding area of research today. Today, the IoTs (Internet of Things) technologies are very much useful in healthcare field. Wireless Body Sensor Networks (WBSN) is a key IoT technique used for patient monitoring. The sensor nodes used in the body sensor network is small in size, easy to deploy but they are limited resources like memory, processor, and energy. This study provides the awareness of publications globally in relation with energy efficient healthcare because it is hot research area in the world. Healthcare data are useful in many research analyses. The architecture faces many difficulties in terms of energy and scalability.

Objectives of the Study

- Calculate the Annual growth rate of the publications in terms of the number of publications in every year, their cumulative value and their percentage.
- The Relative Growth rate and doubling time is calculated and analyzed.
- The Authors who published maximum number of publication are to be found
- Rank the subject area which have more number of publications
- Different document types and source types are ranked.
- Common keywords used in these publications are to be found.
- Different source titles are analyzed.

Data Collection and Some Aspects Regarding the Study

The data for this study is collected from the SCOPUS database for the year 2008 to 2018 using the keyword Energy efficient and Healthcare. For the study, the data is extracted to MS OFFICE EXCEL. The aspect is, the study is only based on the data collected from the SCOPUS.

Annual Growth

In Figure1, the table lists the Year and the Number of publications, their cumulative strength and its percentage. The graphical representation is shown in the chart. It shows that in 2013, the highest numbers of papers are published in this field i.e. 9 and in percentage wise it is 15%.

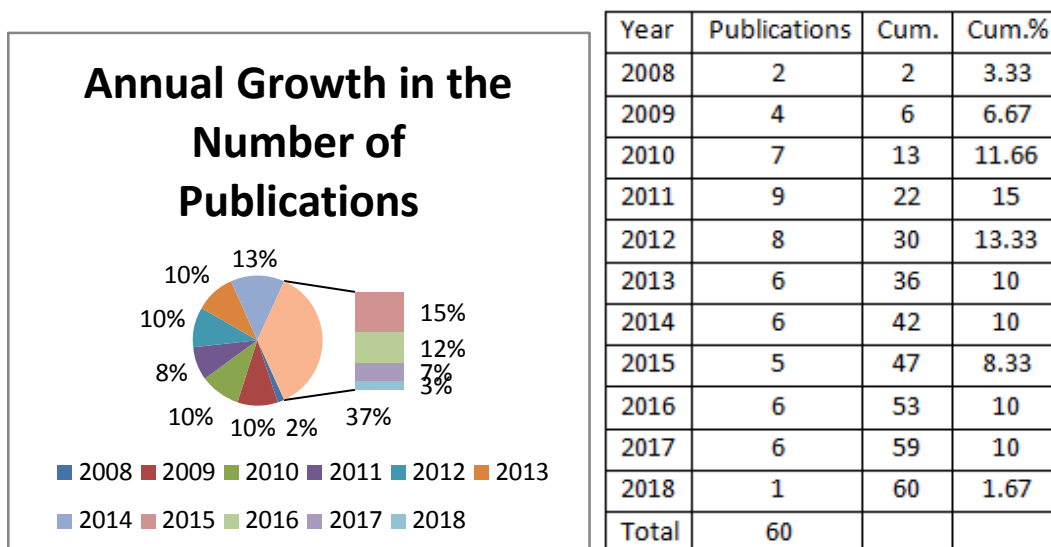


Figure 1: Annual Growth

Relative Growth Rate and Doubling Time

Table 1 displays the relative growth rate and doubling time on the publications collected for the year 2008 to 2018. 1.099 is found as the highest value of relative growth rate.

Table 1: RGR and Doubling Time

Year	Number of publications	Cumulative	W1	W2	RGR = (W2-W1)	DT = 0.693/RGR
2008	2	2	0	0.693	0.693	0.000
2009	4	6	0.693	1.792	1.099	0.631
2010	7	13	1.792	2.565	0.773	0.896
2011	9	22	2.565	3.091	0.526	1.317
2012	8	30	3.091	3.401	0.310	2.234
2013	6	36	3.401	3.584	0.182	3.801
2014	6	42	3.584	3.738	0.154	4.496
2015	5	47	3.738	3.850	0.112	6.161
2016	6	53	3.850	3.970	0.120	5.768
2017	6	59	3.970	4.078	0.107	6.462
2018	1	60	4.078	4.094	0.017	41.233
Total	60					

Ranking of Top Authors with Highest Number of Publications

Figure 2 shows the top authors with the highest number of publications related to the keyword Energy Efficient and Healthcare. The data collect from the Scopus database contains totally 164 authors. Only 4 authors have contributed in 2 papers each. Others have a single contribution.

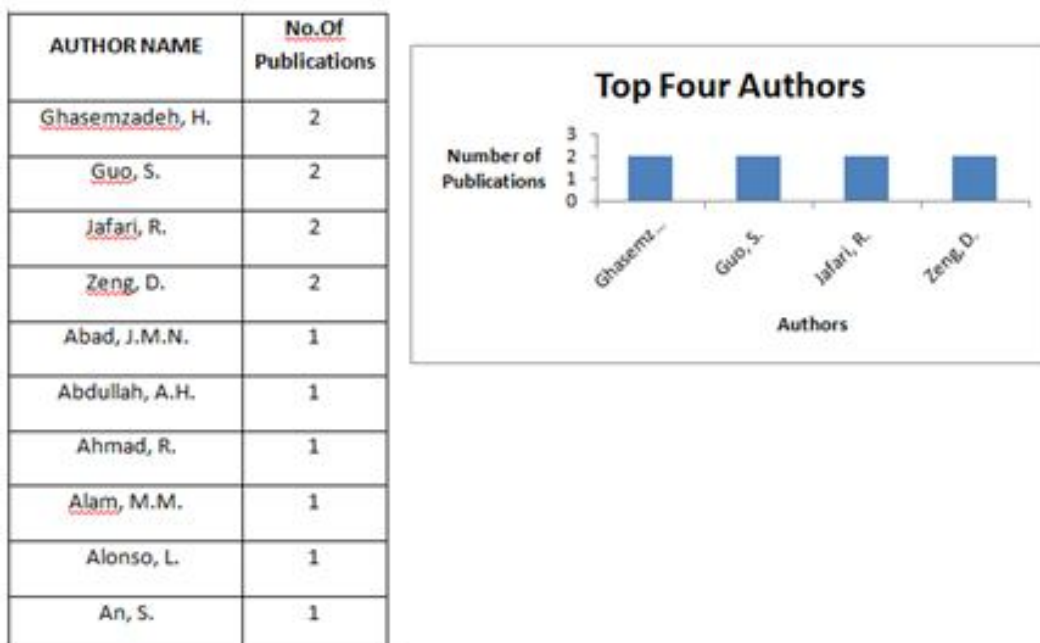


Figure 2: Top Authors

Ranking of Subject Areas

Figure 3 shows all the subject areas contributed to the publications collected from the SCOPUS data. The publications include 16 different subject areas. In this Engineering contains highest number of publications with 37. The second highest contribution is by computer science with 33 publications.

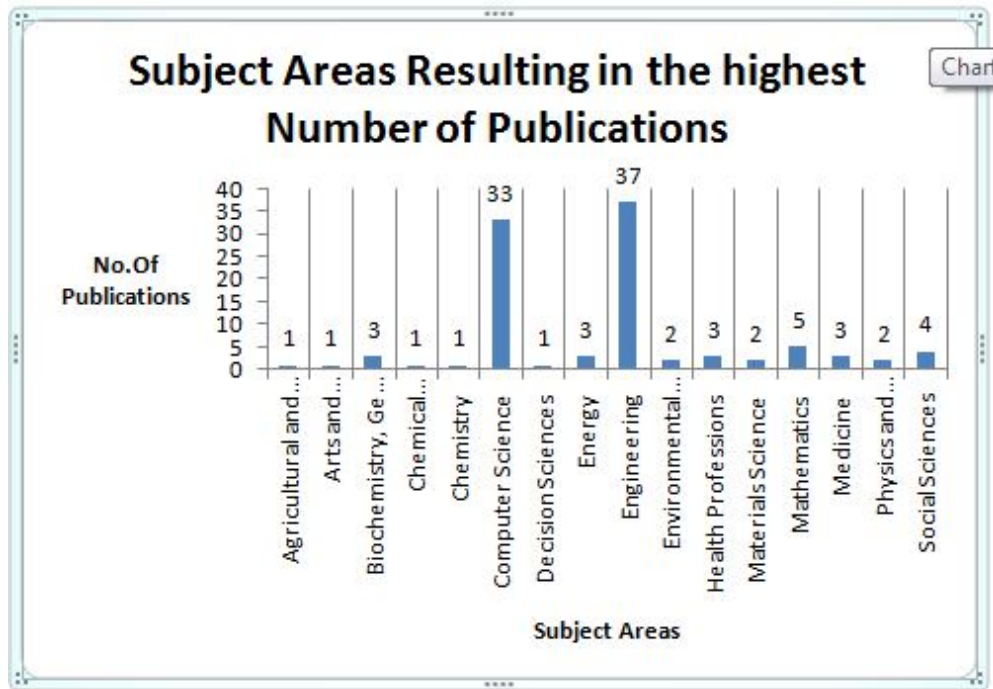


Figure 3: Subject Areas

Ranking Document Types

Figure 4 displays four different document types, number of publications and its percentage. The common document types which are identified in these publications are conference papers. Totally 30 publications are found under this category. The second common document type found in these publications is Article.

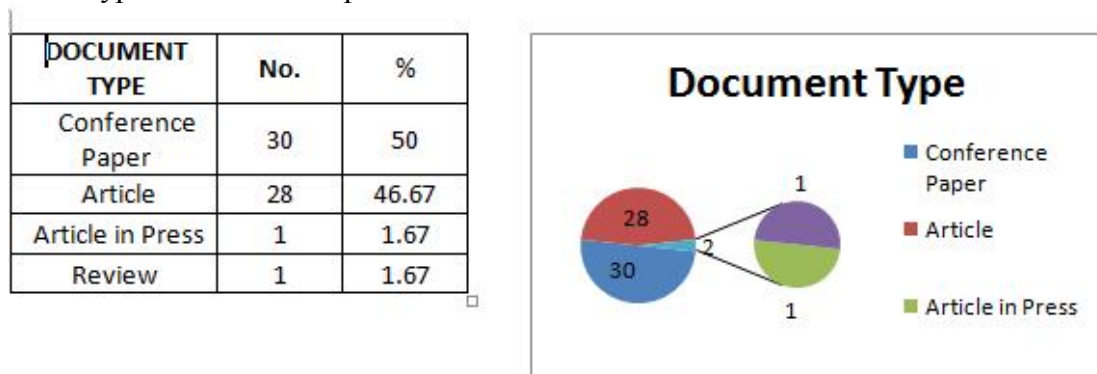


Figure 4: Document Types

Top Source Titles

Table 2 depicts the top six source titles of the publications collected during the year 2008 to 2018 in energy efficient healthcare field. International conferences / Symposiums/ Workshops contribute to the largest number of papers i.e. 15 publications. The second

highest contribution by IEEE Journals/Transactions with 11 publications. The third position goes to IEEE conferences with 6 publications.

Table 2: Source Titles

SOURCE TITLE	No. of Publications	%
International Conferences/Symposiums/Workshops	15	25
IEEE Journals/Transactions	11	18.33
IEEE Conferences	6	10
ASHRAE Journal	2	3.33
Engineered Systems	2	3.33
Wireless Personal Communications	2	3.33

Top Ten keywords

Figure 5 highlights the commonly occurring keywords found from the publication data collected from SCOPUS data. Energy Efficiency is the most common keyword found in 43 publications. The second common keyword is healthcare with 37 occurrences. The third position is Wireless Sensor Networks with 18 publications.

Ranking	KEYWORD	Number	%
1	Energy Efficiency	43	18.53
2	Energy Efficient	40	17.24
3	Health Care	37	15.94
4	Wireless Sensor Networks	18	7.76
5	Sensor Nodes	15	6.47
6	Energy Utilization	13	5.6
7	Sensor Networks	12	5.17
8	Communication	10	4.31
9	Healthcare	9	3.88
9	Healthcare Facility	9	3.88
9	Healthcare Monitoring	9	3.88
9	Wireless Body Area Network	9	3.88
10	Wireless Local Area Networks (WLAN)	8	3.44
	Total	232	100

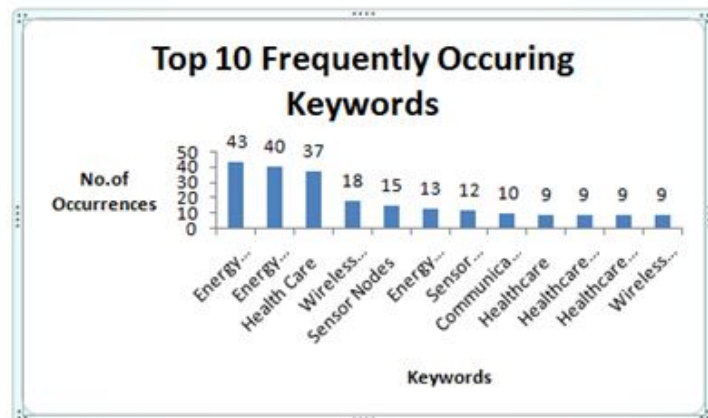


Figure 5: Top 10 Keywords

Ranking Source Types

Different source types of the publications are described in Figure 6. The most common source type of the publications is journals. From the collected publications, 29 are come under the source type journals, 27 publications belongs to conference proceedings, book series and trade publications have 2 publications in each.

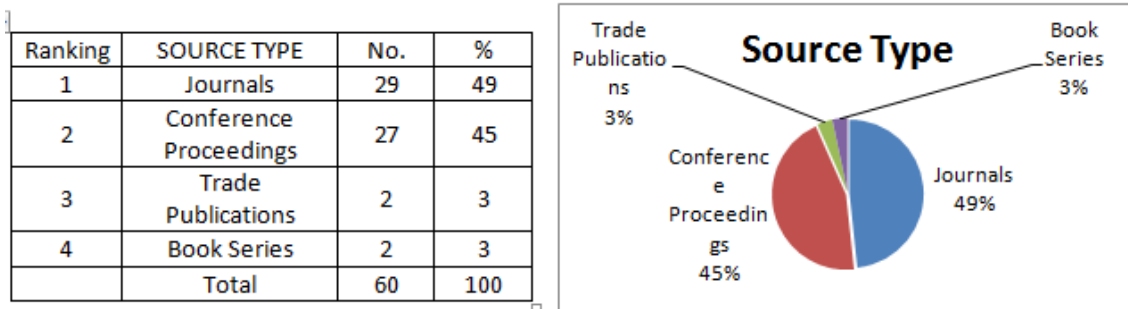


Figure 6: Source Types

Conclusion

This study was conducted based on the Publications collected from the SCOPUS database using search keywords Energy Efficient and Healthcare. The analysis is carried out for the time period of 11 years (2008 to 2018). 60 publications are collected altogether. The growth rate of the publications regarding these keywords is analyzed. The highest relative growth rate is 1.099. Majority of the publication’s document type is conference papers. The common source type found is journals and the keyword commonly occurred is Energy Efficient.

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