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BIBLIOMETRICAL ANALYSIS OF RESEARCH PUBLISHED IN OIL SHALE

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Abstract. *About five years ago, in 2011, Prof. Volli Kalm wrote a short review of the bibliometrical analysis of Oil Shale, an Estonian journal covering all aspects of science and technology related to oil shale. Now, a few years later, it would be good to take another, more up-to-date look at Oil Shale and its bibliometrical data to see how the journal's role and pertinent information have changed since 2011.*

In the last years, a lot has changed in bibliometrics and scientometrics. Bibliometrical analysis is still an everyday part of science and scientific analysis just as a peer review, but the range of bibliometrical indicators has widened from superficial indicators like citation count and h-index to more specific indicators like field-normalized citation rate and journal quartile score. These new indicators enable us to have a deeper insight into a journal's impact within its own field.

Strong competition between Thomson Reuters Web of Science and Elsevier Scopus has made them two of the largest, most reliable and prestigious databases in the world. There is little doubt about the quality of information in these databases. The data contained may sometimes be different but this does not affect their overall value. Although criticized by some users for being more useful for those fields of research whose numbers of citations are higher, both have followed a fair and equal policy towards all of them.

This short review of the bibliometrical indicators of Oil Shale was made using data from the following databases: Web of Science Core Collection (WoS), Journal Citation Reports (JCP), Scopus and SCImago. Data was taken on the 2nd of November 2014.

1. Oil Shale ranking

1.1. Impact factor by WoS

The journal Oil Shale is positioned in the Energy & Fuels and Engineering research domains in Web of Science (WoS). In the 2014 edition of the Journal Citation Reports, Oil Shale is placed in the third quartile (Q3) in the Energy & Fuels category and in the first quartile (Q1) in the Engineering,

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Petroleum category. The value of an Impact Factor (IF) itself does not show the relative importance of a journal. Instead, the Impact Factors of journals of the same field must be compared to elucidate their ranking. The Quartile in Category or the Quartile Score, on the other hand, shows the relative location of a journal along the range of an Impact Factor distribution. Oil Shale falls into the highest quartile (Q1) in the Engineering, Petroleum category and is among the top 25% of the IF distribution. In the Energy & Fuels category it is in the third quartile (Q3), which refers to a middle-low position. Among the 20 journals in the Engineering, Petroleum category, Oil Shale ranked 5th with an impact factor of 0.762. In the Energy & Fuel category, Oil Shale was placed 66th among 89 journals (79 scholarly periodicals in 2010, Oil Shale being 61th) (Fig. 1).

In 2011, Volli Kalm wrote that the impact factor of Oil Shale was the highest in 2009, being 0.815 [1]. A new record height was reached in 2011 when the journal's impact factor was 0.838 (the same value was also reached in 2013). As seen from Figure 2, the impact factor of Oil Shale has been rising since 2010.

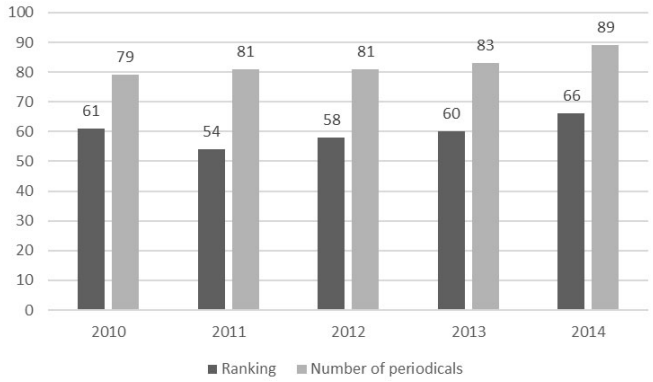

Fig. 1. Oil Shale ranking in the Energy & Fuel category in the Journal Citation Reports in 2010–2014.

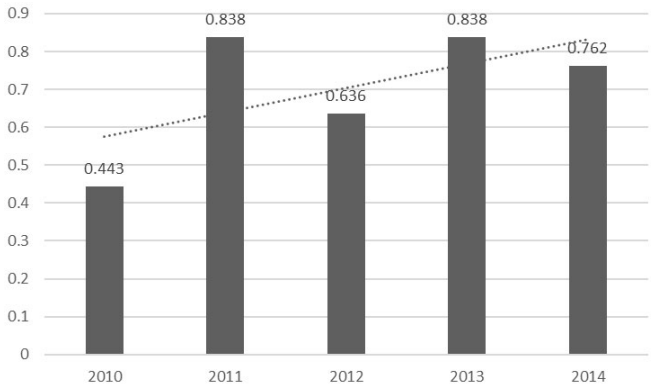

Fig. 2. Impact factor of Oil Shale in 2010–2014.

1.2. SCImago Journal Rank by Scopus

For journal evaluation Scopus uses SCImago Journal Rank (SJR). SJR is weighted by the prestige of a journal. Subject field, quality and reputation of the journal have a direct effect on the value of a citation. SJR also normalizes differences in citation behavior between subject fields. In terms of SJR, Oil Shale is represented in three categories: Energy Engineering and Power Technology, Fuel Technology, and Geotechnical Engineering and Engineering Geology. In all of these categories Oil Shale is situated in the second quartile and has been staying in this quartile since 1999 (except in 2005 when it was not in the database). When it comes to the 2014 quartile, Oil Shale ranked 68th among the 158 journals in the Energy Engineering and Power Technology category, 38th among the 78 journals in the Fuel Technology category and 74th among the 154 journals in the Geotechnical Engineering and Engineering Geology category. Among all of the SJR-evaluated 22 878 journals, Oil Shale ranked 10 841st, being with this figure second of all Estonian journals represented in the table.

As seen from Figure 3, Oil Shale's SJR shows a descending trend in the last five years, but considering that the 2010 SJR exhibited the peak since 1999, the overall trendline is rising.

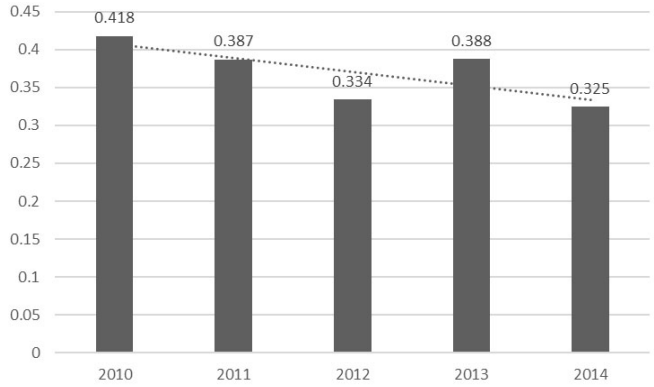

Fig. 3. Oil Shale's SJR in 2010–2014.

2. Articles and authors

2.1. Citations in WoS

By November 2014, WoS included 876 publications from Oil Shale, which had been cited 2910 times (without self-citations the number was 1799) altogether by 1373 articles. The number of citations per publication (CPP) was 3.32 and h-index 18. As seen from Figure 4, the number of citations in a year has been growing fast since 1997. Over the years, the trend has been strongly acclivous, with 2015 promising to be the best year hitherto.

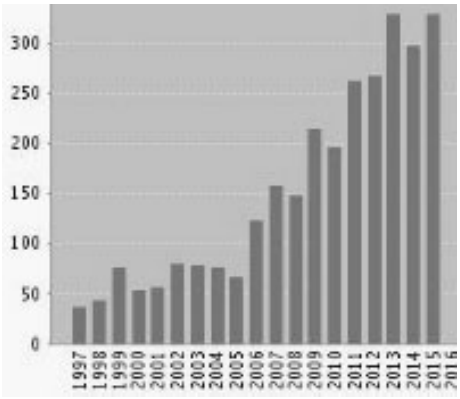

Fig. 4. Citations of Oil Shale in WoS by year.

As mentioned above, the number of citations per published item in Oil Shale was 3.32. From Table 1 it can be seen that the most common document type in WoS in 2014 was article. At the same time, the most cited document was proceedings paper, with CPP of 10.5 (Fig. 5), as was also the case in 2011 (CPP was 4.82). This, as pointed out by Kalm in 2011, is an argument for supporting the publication of more special volumes of Oil Shale with a fair, yet rigorous selection of manuscripts [1].

Contributing authors were mostly from Estonia (494), followed by the People's Republic of China (101), Turkey (45), Russia (33), USA (18) and Jordan (16), altogether 37 countries being represented.

In terms of the number of publications, the most fruitful authors were L. Tiikma (23), E. Reinsalu (23), R. Kuusik (23) and I. Johannes (22), all from Tallinn University of Technology, Estonia.

Table 1. The most common document types in WoS*

	Article	Editorial material	Proceedings paper	Review	Biographical item	Item about an individual	Correction	News item	Correction addition	Discussion	Letter
Number of documents 876*	695	102	34	24	24	11	6	6	3	2	3
% of 876	79.30	11.64	3.88	2.74	2.74	1.25	0.68	0.68	0.34	0.22	0.34
CPP	3.83	1.37	10.5	4.54	0	0	0	0	0	0	0

* 34 documents have two document types (article, proceedings paper). This is why the sum is not 876 and percentage not 100. (CPP – number of citations per publication).

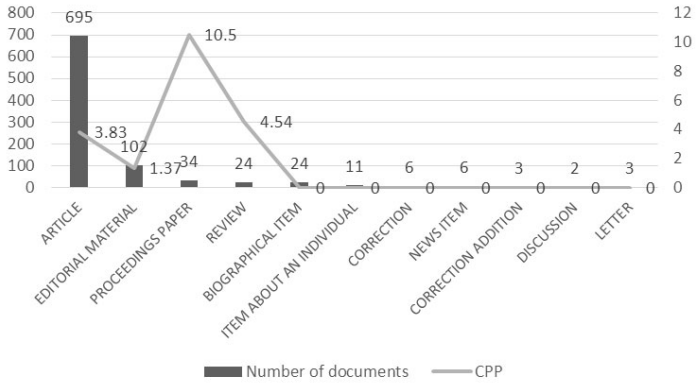

Fig. 5. The most common document types in WoS and number of citations per publication (CPP), November 2014.

By November 2014, Oil Shale had been cited 1799 times, self-citations excluded. Out of the 966 cited articles, 281 were from Estonia, 192 from the People's Republic of China and 101 from the USA. The journals citing most were the same as in 2011 – Fuel (53), the Journal of Thermal Analysis and Calorimetry (42), and Energy & Fuels (39).

The most frequently cited papers from Oil Shale were also the same as in 2011, only the number of citations had, in some cases, doubled or even tripled. The papers in question were:

Dyni, J. R. Geology and resources of some world oil-shale deposits. *Oil Shale*, 2003, **20**(3), 193–252, (cited 70 times).

Kuusik, R., Uibu, M., Kirsimäe, K. Characterization of oil shale ashes formed at industrial-scale CFBC boilers. *Oil Shale*, 2005, **22**(4S), 407–419, (cited 50 times).

Qian, J., Wang, J., Li, S. Oil shale development in China. *Oil Shale*, 2003, **20**(3S), 356–359, (cited 41 times).

2.2. Citations in Scopus

By November 2014, Scopus included 606 publications which had been cited 2611 times. The number of citations of Oil Shale in Scopus showed a rising trend (Fig. 6). The h-index of Oil Shale was 18. The number of citations per publication was 3.234.

As in WoS, the most common document type in Scopus in 2014 was article (497) (Table 2.). However, reviews with 9.91 citations per article seemed to have had the most impact (Fig. 7). This discrepancy may be explained by the different categorization of publications. In WoS, for example, the most cited document by type was article, but in Scopus, it was review.

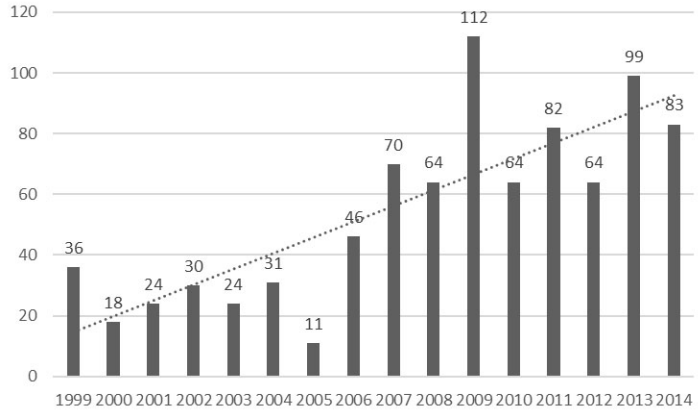

Fig. 6. Citations of Oil Shale in Scopus by year.

Table 2. The most common document types in Scopus, November 2014

	Article	Editorial	Review	Conference paper	Erratum	Note
Number of documents	497	53	36	15	4	1
% of 606	82.01	8.74	5.94	2.47	0.66	0.16
CPP	4.17	1.81	9.91	6.9	0	0

Note: CPP – number of citations per publication.

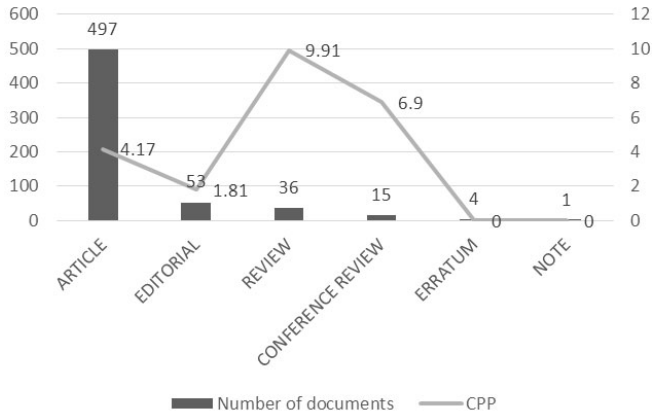

Fig 7. Document types and number of citations per item in Scopus, November 2014.

Contributing authors represented in Scopus came mostly from Estonia (352), followed by the People's Republic of China (94), Turkey (45), USA (37), Russia (17), and Jordan (16), altogether from 36 countries.

In terms of the number of publications the most productive authors were R. Kuusik (22), L. Tiikma (22), I. Johannes (19) and T. Pihu (17).

Without self-citations there were 1072 articles which had cited Oil Shale. Out of these 1072 articles, 264 were from Estonia, 244 from the People's Republic of China and 130 from the USA. The journals citing most often were the same as in 2011 – Fuel (52), Fuel Processing Technology (40) and Energy & Fuels (38).

In Scopus, the most frequently cited papers from Oil Shale were almost the same as in WoS, except the article by Wang, Q. et al., which was missing in Scopus. The following articles accounted for most of the citations:

Dyni, J. R. Geology and resources of some world oil-shale deposits. *Oil Shale*, 2003, **20**(3), 193–252, (cited 99 times).

Kuusik, R., Uibu, M., Kirsimäe, K. Characterization of oil shale ashes formed at industrial-scale CFBC boilers. *Oil Shale*, 2005, **22**(4S), 407–419, (cited 50 times).

Wang, Q., Bai, J., Sun, B., Sun, J. Strategy of Huadian oil shale comprehensive utilization. *Oil Shale*, 2005, **22**(3), 305–315, (cited 36 times).

3. Distribution of words in article titles

The title of a publication provides quite a close picture of its topic. The synthesized analysis of the use of words in titles was developed in recent years, and has proved to be helpful information in revealing research focuses [2]. The use of all the 7179 words in the 842 titles of articles published in Oil Shale in the years 1994–2013 was subjected statistical analysis. The 20 most frequently used words in article titles in Oil Shale during that period are listed in Table 3.

From Table 3 it can be seen that "oil", "shale", "Estonian" and "Estonia" were the most used words in Oil Shale and this is not surprising. However, the use of the terms "power", "pyrolysis", "energy" and "analysis" has shown a notable increasing trend in the years since 1994. At the same time, the use of "shales", "processing" and "industry" has exhibited a decreasing trend. This indicates that the focus of research published in Oil Shale has shifted towards new subjects or the entire field itself has changed with Oil Shale.

Table 3. The 20 most frequently used words in article titles in Oil Shale during 1994-2013 and four 5-year periods

Words in titles	TA	94–13 R (%)	94–98 R (%)	99–03 R (%)	04–08 R (%)	09–13 R (%)
Oil	566	1 (7.9)	1 (5.8)	1 (8.7)	1 (8.0)	1 (8.3)
Shale	521	2 (7.3)	2 (5.5)	2 (7.6)	2 (7.1)	2 (8.0)
Estonian	122	3 (1.6)	3 (2.2)	3 (1.7)	3 (1.7)	4 (1.1)
Estonia	72	4 (1.0)	5 (1.2)	4 (1.2)	5 (1.0)	7 (0.7)
Power	68	5 (0.9)	178 (0.1)	13 (0.5)	4 (1.6)	3 (1.4)
Mining	56	6 (0.7)	7 (0.8)	6 (0.7)	7 (0.8)	8 (0.7)
Ash	51	7 (0.7)	17 (0.4)	7 (0.7)	6 (0.9)	13 (0.5)
Shales	50	8 (0.6)	6 (0.8)	5 (0.8)	10 (0.7)	14 (0.9)
Combustion	45	9 (0.6)	9 (0. 7)	8 (0.6)	8 (0.7)	22 (0.3)
Pyrolysis	43	10 (0.5)	77 (0.1)	34 (0.3)	9 (0.7)	5 (0.9)
Oil shale	39	11 (0,5)	4 (1.9)	115 (0.1)	110 (0.1)	182 (0.1)
Processing	36	12 (0.5)	8 (0.7)	14 (0.5)	18 (0.4)	34 (0.3)
Energy	34	13 (0.4)	35 (0.3)	183 (0.1)	12 (0.5)	6 (0.8)
Industry	33	14 (0.4)	10 (0.6)	9 (0.6)	21 (0.4)	60 (0.2)
Analysis	33	15 (0.4)	111 (0.1)	15 (0.4)	19 (0.4)	9 (0.7)
Kukersite	32	16 (0.4)	12 (0.5)	28 (0.3)	24 (0.4)	21 (0.4)
Study	30	17 (0.4)	22 (0.3)	30 (0.3)	44 (0.2)	10 (0.7)
Composition	29	18 (0.4)	11 (0.5)	11 (0.5)	73 (0.2)	50 (0.2)
Production	29	19 (0.4)	16 (0.4)	24 (0.3)	26 (0.3)	15 (0.4)
Impact	28	20 (0.3)	31 (0.3)	10 (0.5)	127 (0.1)	12 (0.5)

Note: TA – total number of articles; R (%) – rank and total percentage of words in article titles.

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