

## METHODOLOGICAL ASPECTS OF ASSESSING REGIONAL PUBLICATION ACTIVITY AND CITATIONS: THE CASE OF THE RF CENTRAL FEDERAL DISTRICT UNIVERSITIES

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### ABSTRACT

The article focuses on calculations to assess contribution made by University publication activity and citations indicators to the regional integral indicator of publication activity and citations for Voronezh Region, Ivanovo Region, and Ryazan Region. It shows that relative indicators are more significant in calculations of this kind therefore regions with a large number of Universities have no advantage. The article offers a triangular matrix of ratios expressing how much one regional integral indicator of publication activity and citations exceeds the other, which was calculated for the RF Central Federal District regions. Ratios range up to 3.47. It is concluded that the offered triangular matrix of ratios can be useful for arbitrary rankings of items by values of some indicator.

**Key words:** publication activity, citations, regional integral indicator of publication activity and citations, RSCI, RF Central Federal District, a triangular matrix of ratios for arbitrary rankings.

### INTRODUCTION

The essential measure of the Russian Universities' regional publication activity and citations is the Russian Science Citation Index (RSCI). Testing the term "Russian Science Citation Index (RSCI)" in Google Scholar advanced search box we discovered a number of articles, which we incorporated in our literature review.

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In research paper [1] the author evaluates the Russian system of citation indexing, launched in 2005, in comparison with Web of Science and expresses his view on how it can be improved. At the same time the analysis of the whole range of articles on this topic shows that the RSCI is currently applied to four main areas: 1. institutions ranking; 2. journals ranking; 3. scientists ranking; 4. scientometric analysis of publications in different subject domains.

The first area of the RSCI application is demonstrated in research papers [2, 3]. Article [2] points to the importance of comprehensive approach to assessing performance of academic institutions on the basis of citation indices including the RSCI and the full range of scientific documents produced in the course of research. At the same time article [3] presents a specific example of rank calculation for 22 Chemical Research Institutes of the Russian Academy of Sciences. The authors note that in 2010 the RSCI had 15 indicators for ranking organisations.

The second area of the RSCI application is found in works [4, 5]. Article [4] analyses distribution of the Russian journals among subject domains and among publishers. It also identifies TOP-10 Russian journals in the RSCI as of January 2016. Research paper [5] ranks 18 scholarly journals of Economics Institutes of the Russian Academy of Sciences.

Works [6, 7] relate to the third area of the RSCI application. Article [6] offers a methodology for ranking researchers via the example of the Russian academic economists. Research paper [7] elaborates this methodology.

The fourth area of the RSCI application is demonstrated in article [8], which studies the document flow in informetrics for 2000-2013. It discovers exponential growth of publications in the field under consideration.

For the purpose of assessing Universities' regional publication activity and citations it is important to give consideration to article [9], which sets a conceptual task to establish and try out a system of measurable indicators for the publication activity of the regional academic community.

## **METHODS**

Works [10, 11] use the case of the Russian Federation Central Federal District Universities to offer methodology for assessing regional publication activity and citations. The research presented in the first article was based on 22 RSCI indicators of publication activity and citations. In the latter article all 36 RSCI indicators of publication activity and citations were used. The indicators were aggregated for all the Universities of each RF Central Federal District region. The aggregation was performed in the following way. For each region, the values of 16 absolute indicators were summed across all the Universities of the region and the

arithmetic mean of 17 relative indicators (share and specific indicators) and 3 Hirsch-type indicators was calculated (table 1). The data received were normalized to maximum values in the sample of Universities (18 Universities) and the arithmetic mean of normalized indicators was calculated.

**Table 1.** The list of the RSCI indicators for University statistics of publications and citations

N	Indicator
1	The cumulative number of publications for 5 years
2	The number of publications in foreign journals
3	The share of publications in foreign journals, %
4	The number of publications in foreign and Russian translated journals
5	The share of publications in foreign and Russian translated journals, %
6	The number of publications in foreign journals and Russian journals listed by the Higher Attestation Commission
7	The share of publications in foreign journals and Russian journals listed by the Higher Attestation Commission, %
8	The number of publications in journals indexed in Web of Science and Scopus
9	The share of publications in journals indexed in Web of Science and Scopus, %
10	The number of publications in the RSCI core journals
11	The share of publications in the RSCI core journals, %
12	The number of publications in journals with impact factor > 0
13	The share of publications in journals with impact factor > 0, %
14	The number of publications cited at least once
15	The share of publications cited at least once, %
16	The number of publications written in international co-authorship
17	The share of publications written in international co-authorship, %
18	The number of publications written in collaboration with other organisations
19	The share of publications written in collaboration with other organisations, %
20	The number of authors
21	The number of authors who have publications in journals indexed in Web of Science and Scopus
22	The share of authors who have publications in journals indexed in Web of Science and Scopus, %
23	The number of authors who have publications in the RSCI core journals

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24	The share of authors who have publications in the RSCI core journals, %
25	The number of citations in RSCI
26	The number of citations in RSCI core
27	The share of citations in RSCI core, %
28	The weighted average impact factor of journals that published the articles
29	The average number of publications per author
30	The average number of citations per publication
31	The average number of citations per author
32	The number of citations in publications outside the organisation
33	The share of citations in publications outside the organisation, %
34	h-index (Hirsch index)
35	I-index
36	G-index

As a result, we had values of regional integral indicator of publication activity and citations for all the RF Central Federal District regions (table 2) and their distribution by the level of publication activity and citations (table 3) [11].

**Table 2.** Regional integral indicator of publication activity and citations

N of the region	Region	Integral indicator values
1	Belgorod Region	0.346
2	Bryansk Region	0.276
3	Vladimir Region	0.329
4	Voronezh Region	0.350
5	Ivanovo Region	0.434
6	Kaluga Region	0.287
7	Kostroma Region	0.300
8	Kursk Region	0.290
9	Lipetsk Region	0.309
10	Moscow Region	0.487
11	Orel Region	0.245
12	Ryazan Region	0.406
13	Smolensk Region	0.303
14	Tambov Region	0.322
15	Tver Region	0.319
16	Tula Region	0.251
17	Yaroslavl Region	0.339
18	Moscow City	0.850

**Table 3.** Distribution of the RF CFD regions by the level of publication activity and citations based on the data from table 5

Variation interval for regional integral indicator values	The level of publication activity and citations	The RF CFD regions	The RF CFD regions exclusive of Moscow City
0.8 – 1.0	Very high	Moscow City	Moscow Region
0.6 – 0.8	High	-	Voronezh Region
0.4 – 0.6	Medium	Moscow Region Ivanovo Region Ryazan Region	Ivanovo Region Ryazan Region Belgorod Region Yaroslavl Region
0.2 – 0.4	Low	Voronezh Region Belgorod Region Yaroslavl Region Vladimir Region Tambov Region Tver Region Lipetsk Region Smolensk Region Kostroma region Kursk Region Kaluga Region Bryansk Region Tula Region Orel Region	Tambov Region Kursk Region Tver Region Vladimir Region Lipetsk Region Smolensk Region Kostroma Region Bryansk Region Orel Region Kaluga Region Tula Region
0 – 0.2	Very low	-	-

The data for these calculations were collected from 27 December, 2016 to 03 February, 2017 [11].

Later we noticed that the values of the integral indicator of publication activity and citations for Ivanovo Region and Ryazan Region were higher than for Voronezh Region, which seemed illogical. In fact, the number of Universities in Voronezh Region (16 Universities) is

almost twice as high as the number of Universities in Ivanovo Region (7 Universities) and Ryazan Region (6 Universities) (table 4).

**Table 4.** Distribution of the number of Universities by 18 subjects of the RF CFD

N of the region	Region	The number of Universities
1	Belgorod Region	6
2	Bryansk Region	5
3	Vladimir Region	3
4	Voronezh Region	16
5	Ivanovo Region	7
6	Kaluga Region	4
7	Kostroma Region	2
8	Kursk Region	7
9	Lipetsk Region	5
10	Moscow Region	24
11	Orel Region	6
12	Ryazan Region	6
13	Smolensk Region	7
14	Tambov Region	4
15	Tver Region	5
16	Tula Region	5
17	Yaroslavl Region	8
18	Moscow City	155

## RESULTS

We expected that explanation for the discrepancy mentioned above lies in prevailing contribution of normalized relative indicators values to the integral indicator of Ivanovo Region and Ryazan Region. To prove the hypothesis we calculated the three regions' normalized indicators contributing to the integral indicator (table 5). In table 5 the background colour is applied to the cells containing the values of initial aggregated indicators and normalized indicators for Ivanovo and Ryazan Regions that exceed the corresponding values for Voronezh Region. The table shows that among such indicators Ivanovo Region has 12 relative indicators (N 3, 5, 7, 9, 11, 13, 17, 19, 22, 24, 27, 33) and Ryazan Region has 16

indicators most of which are relative ones (N 3, 5, 9, 11, 15, 17, 22, 24, 26, 27, 28, 30, 31, 33, 34, 36).



**Table 5.** Contribution of publication activity and citations indicators to the regional integral indicator of publication activity and citations calculated for three RF CFD regions

Region	N of the indicator																																			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
Voronezh Region	8173	146	1.	483	3.	279	38.	256	1.	674	4.3	391	57.	194	25.	726	0.	157	22.	934	165	8.5	312	19.	785	524	3.6	0.	8.	0.	8.4	332	0.	36.	10.	54.
Ivanovo Region	1642	597	3.	202	9.	762	47.	167	9.	318	18.	115	66.	408	23.	308	1.	310	24.	281	801	23.	112	38.	122	412	25.	0.	5.	0.	4.3	594	0.	22.	9.5	34.
Ryazan Region	2151	364	2.	702	4.	760	37.	685	3.	128	6.7	100	48.	504	26.	200	1.	317	20.	262	337	12.	642	26.	311	924	15.	0.	8.	1.	11.	196	0.	36.	10.	61.
MAX	9210	282	3.	756	9.	358	52.	657	9.	119	18.	461	73.	202	26.	188	2.	195	40.	105	300	23.	423	38.	921	206	25.	0.	8.	1.	11.	617	0.	37.	12.	61.
	71	62	96	36	69	610	9	74	1	860	24	268	77	896	92	60	79	970	94	104	15	5	46	46	371	286	4	55	77	67	87	159	75	25	83	67

Region	N of the indicator																																				Инт.	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	SUM	SUM*(1/36)
Voronezh Region	0.0	0.0	0.3	0.0	0.3	0.0	0.7	0.0	0.1	0.0	0.2	0.0	0.7	0.1	0.9	0.0	0.1	0.0	0.5	0.0	0.0	0.3	0.0	0.5	0.0	0.0	0.1	0.6	1.0	0.5	0.7	0.0	0.5	0.9	0.8	0.8	12.6	0.35
Ivanovo	0.0	0.0	0.8	0.0	0.9	0.0	0.9	0.0	1.0	0.0	1.0	0.0	0.8	0.0	0.8	0.0	0.5	0.0	0.5	0.0	0.0	1.0	0.0	1.0	0.0	0.0	1.0	0.6	0.6	0.4	0.3	0.0	0.6	0.6	0.7	0.5	15.6	0.43

Region	2	2	4	3	6	2	0	3	0	3	0	3	9	2	6	2	9	2	9	3	3	0	3	0	1	2	0	2	6	4	6	1	5	0	5	7	3	
Ryazan	0.0	0.0	0.5	0.0	0.4	0.0	0.7	0.0	0.3	0.0	0.3	0.0	0.6	0.0	1.0	0.0	0.4	0.0	0.5	0.0	0.0	0.5	0.0	0.6	0.0	0.0	0.5	1.0	0.9	0.8	1.0	0.0	0.8	0.9	0.8	1.0	14.6	
Region	2	1	2	1	3	2	2	1	7	1	7	2	6	2	0	1	9	2	0	2	1	3	2	8	3	4	9	0	4	7	0	3	4	8	2	0	3	0.41

Accordingly, it becomes clear why in spite of having high values of absolute indicators Voronezh Region gave way to Ivanovo Region and Ryazan Region.

The values of the regional integral indicator of the publication activity and citations presented in table 2 were ranked (table 6).

**Table 6.** The RF CFD regions ranked by the value of the regional integral indicator of publication activity and citations

N of the region	Region	Integral indicator values
1	Moscow City	0.850
2	Moscow Region	0.487
3	Ivanovo Region	0.434
4	Ryazan Region	0.406
5	Voronezh Region	0.350
6	Belgorod Region	0.346
7	Yaroslavl Region	0.339
8	Vladimir Region	0.329
9	Tambov Region	0.322
10	Tver Region	0.319
11	Lipetsk Region	0.309
12	Smolensk Region	0.303
13	Kostroma Region	0.300
14	Kursk Region	0.290
15	Kaluga Region	0.287
16	Bryansk Region	0.276
17	Tula Region	0.251
18	Orel Region	0.245

For any list of items ranked by values of some indicators it is possible to create a triangular matrix of ratios expressing how much one indicator's value exceeds the other. The following triangular matrix (table 7) was created for the values presented in table 6.

Table 7. Triangular matrix of ratios expressing how much values of one regional integral indicator of publication activity and citations exceed the other

№	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	
1	1	1.75	1.96	2.09	2.43	2.46	2.51	2.58	2.64	2.66	2.75	2.81	2.83	2.93	2.96	3.08	3.39	3.47	
2		1	1.12	1.20	1.39	1.41	1.44	1.48	1.51	1.53	1.58	1.61	1.62	1.68	1.70	1.76	1.94	1.99	
3			1	1.07	1.24	1.25	1.28	1.32	1.35	1.36	1.40	1.43	1.45	1.50	1.51	1.57	1.73	1.77	
4				1	1.16	1.17	1.20	1.23	1.26	1.27	1.31	1.34	1.35	1.40	1.41	1.47	1.62	1.66	
5					1	1.01	1.03	1.06	1.09	1.10	1.13	1.16	1.17	1.21	1.22	1.27	1.39	1.43	
6						1	1.02	1.05	1.07	1.08	1.12	1.14	1.15	1.19	1.21	1.25	1.38	1.41	
7							1	1.03	1.05	1.06	1.10	1.12	1.13	1.17	1.18	1.23	1.35	1.38	
8								1	1.02	1.03	1.06	1.09	1.10	1.13	1.15	1.19	1.31	1.34	
9									1	1.01	1.04	1.06	1.07	1.11	1.12	1.17	1.28	1.31	
10										1	1.03	1.05	1.06	1.10	1.11	1.16	1.27	1.30	
11											1	1.02	1.03	1.07	1.08	1.12	1.23	1.26	
12												1	1.01	1.04	1.06	1.10	1.21	1.24	
13													1	1.03	1.05	1.09	1.20	1.22	
14														1	1.01	1.05	1.16	1.18	
15															1	1.04	1.14	1.17	
16																1	1.10	1.13	
17																	1	1.02	
18																			1

For example, this matrix shows that a pair of regions (1, 2) has the ratio equal to  $0.850/0.487=1.75$ ; a pair of regions (1, 18) has the ratio equal to  $0.850/0.245=3.47$ . The numbers of regions are indicated in table 6. In the matrix offered here ratios increase in lines and decrease in columns. Variation of the ratios is rather small, it is 1-3.47.

We believe that the triangular matrix of ratios offered here can be useful for arbitrary rankings of items by values of some indicator.

## CONCLUSION

We build our research upon the values of regional integral indicator of publication activity and citations calculated earlier for 18 RF Central Federal District regions and focus on the

detailed analysis of contribution made by particular publication activity and citations indicators to the regional integral indicator for three regions: Voronezh Region, Ivanovo Region, and Ryazan Region. Research demonstrates that despite high normalized aggregated values of absolute publication activity and citations indicators that Voronezh Region has in comparison with the other two regions mentioned above its regional integral indicator is lower. It is shown that normalized relative indicators have major significance in this respect. We offer a triangular matrix of ratios expressing how much one regional integral indicator of publication activity and citations exceeds the other, which was calculated for the RF Central Federal District regions. In it ratios increase in lines and decrease in columns. Variation of the ratios is 1-3.47, which is rather small. The latter figure shows that the value of Moscow's regional integral indicator of publication activity and citations exceeds the similar indicator value of Orel Region ranked the lowest in the list.

In general terms, this is a triangular matrix of ratios expressing how much one indicator exceeds the other useful for arbitrary rankings of items.

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