of this time showed qualitative changes which the latest ICTs introduced into research activity. From a means of interpersonal communication, which were often decided by the scientific and organizational problems, there were also the most responsive source of scientific information. Exactly, *information* and *communication* compose the basis of productivity of scientist. Many new features, such as the use of international data-bases, participate in global trade networks, setting out its tasks to other people's computers, etc., etc. And these opportunities were actually used, which was clearly documented by empirical evidence.

Only one impatiently waiting result did not manifest itself. Not only in 1995 but also in 1998, data processing was not identified positive effects of ICTs on the professional productivity of scientists. Both surveys showed the same correlation: the scientists who were most actively and successfully engaged in scientific work, were also active users of ICTs, but an inverse relationship was absent — "super active" in the ICTs group was weaker for scientific achievements of other users. AND minimally active group of users of ICTs showed excellent academic results, especially for the publication indicator. All this lead to the conclusion that the active use of ICTs is rather the *consequence* of a common professional activity but not the *cause* of professional success scientists.

After 1998, no radical events in the academic system of RAS was not happening. Over time, innovation has become a familiar comfort. Everyone understood that it speeds up certain kinds of work, but sociologists trusted their data and knew, to their regret, that this innovation does ***not increase*** the productivity of scientific activity. It was unclear and provoked disturbance, so, in 2001/02, a third survey was made with special attention to this phenomenon. Apparently, the past years were the time of ripening stage for results of innovation. Data obtained in this survey were non-trivial and have revealed exactly a long-awaited law.

This survey, fixing up the three years since the previous one, has clearly demonstrated a radical change in the role of ICTs in research teams. Completely in all groups of respondents appeared stable positive correlation between the use of ICTs and professional productivity. Major users of ICTs significantly improved their productivity as the increase of number of publications and reports and participation in international grants. Extra-active ICTs team took first place and on indicators of professional performance. And previously successful team which little use ICTs significantly lost its effectiveness. So, on the basis of empirical evidence 10-year monitoring of concrete innovation, there was first shown unequivocally positive final correlation between the degree of involvement of the scientists in the ICTs and their professional success (*Mirskaya,* 2009; *Mirskaya,* 2010).

But innovations also have their own development and it is impossible to satisfy the needs of scientists in communication and information technologies once and for all. Constant updating of information and communication infrastructure of national science is necessary even in order to keep abreast of international scientific information and to maintain international contacts. Therefore, our prospects for success in the global science seriously linked to the emphasis in the near future will be on further implementation and, most importantly — the development of advanced information and communication technologies. Our complex history of this innovation has one simple conclusion: do not rush to assess the impact of innovations. Their prospects have to be carefully weighed beforehand, but then do not rush the evaluation: that is impossible to receive "all at once".

Literature

Mirskaya E. Z. Modern information and communication technologies in the professional activities of Russian scientists // Science in Russia. From the present to the future / ed. by V. S. Arutyunov. Moscow: URSS, 2009. P. 323–344.

Mirskaya E. Z. New information and communication technologies in the Russian academic science: history and results // Sociology of Science and Technology. 2010. T. 1. № 1. P. 127–139.

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Russian Mathematical Journals in World and National Corpora of Scientific Journals: bibliometric analysis

In memoriam of Vladimir Arnold

The present paper is devoted to a discussion of results of the bibliometric analysis of a number of mathematical journals (more than 700) and scientific fields of knowledge (more than 50) in the JCR databases for the 1998–2010 period. An attempt is made to assess Russian journals in the mathematical sciences in the world and national corporaofscientificjournalsby the impact factor Ip and the normalized impact factor K.

Keywords: bibliometric analysis, mathematical journals, Normalized Impact Factor K, Impact factor, ranking lists, ISI Web of Knowledge: Journal Citation Reports Science Edition

Introduction

Since the beginning of the 1960-ies, a new direction in the study of science has been gaining ground — the quantitative analysis of information flows (bibliometrics). (Some precedents of bibliometric studies go back to 1917). A specific feature of bibliometrics is the use of secondary information: all kinds of bibliographic indexes, abstracts, etc. The corresponding statistics are of substantial interest for the analysts of the development of science, they can help in the planning and management of science. The objects counted in bibliometrics are authors, journals, thematic groupings, organizations, words, etc. Bibliometrics is aimed at the quantitative analysis of documentary output in science as a whole or in specific fields of science. The bibliometric approach opens new vistas for the study of science, supplying it with an empirical base covering both the science's past and (which is especially important) the forefront of science in the making.

Citation analysis is a standard bibliometric instrument very popular in the study of science. It is usually conducted in order to 1) retrieve documents; 2) use the corresponding information for evaluating the impact of papers, journals, countries, etc. (this is the most popular bibliometric research, it is based on citation data); 3) use co-citation information in the study of the structure of science or a scientific field. Better understanding of the development of science can be achieved with the help of such new tools as models of citation in scientific periodicals, co-citation maps of papers and authors, dynamical analysis of thematic regions, techniques of lexical monitoring of science (dynamics of word use, interrelations of keywords, etc.)

Various bibliometric methods fall into two major approaches. The first is based on the analysis of the dynamics of individual features: “plain bibliometrics”. The second is associated with the study of the correlation between objects, their clustering and classification: “structural bibliometrics”. The development of both approaches in bibliometric studies was greatly facilitated with the advent of the ISI/Thomson Reuters systems, which are a universal (world-wide and polythematic) information base.

In this study, the methods of plain bibliometrics were used for the assessment of scientific journals in the mathematical fields of science.

1. Bibliometric analysis of scientific journals

The structure of the ISI/Thomson Reuters database — Journal Citation Reports (JCR) gave rise to some fine bibliometric tools for the analysis of scientific journals. Perhaps the best example of such new indicators is the *Impact Factor* and *Immediacy Index*. The first indicator reflects the average citation of papers from a given journal (during the last two years). The immediacy index is ‘a measure of how quickly “the average cited article” in a particular journal is cited’. Both indices measure the importance and prestige of a journal with in the professional community. They rapidly became popular among librarians as guidelines for selecting the most effective journals for big libraries and information centers (see Marshakova-Shaikevich, 2008: 166–175). The analysis of scientific periodicals is a very popular field of study not only in Information and Library Science. Bibliometric analysis of scientific journals was always at the focus of attention of researchers from different fields of science as well as of sociologists of science. The very existence of JCR provides a unique possibility for this kind of research. E. Garfield (Garfield, 2006: 90–93) wrote that “I first mentioned the idea of impact factor in *Science* in 1955… In the early 1960s, Irving H. Sher and I created the journal impact factor to help select journals for the new *Science Citation Index* (SCI)”.

The evaluation of scientific journals was always one of the main tasks of bibliometric and webometric studies. A search of the SCI for the term “impact factor” produces 1,187 papers for the period 1996–2008. There are 48 papers, which present basic concepts, using and modifying the impact factor and also addressing critical issues in the Scientometrics Guidebook (Scientometrics Guidebook Series, 2007).

The Journal Citation Reports served as a basis for further invariant or integrative indicators, such as the ‘discipline impact factor’ of Hirst (Hirst, 1978: 171–172), or the ‘total citation influence measure’ (Narin, Pinsski, Gee, 1976). This contributed to a better understanding of the cognitive structure of the field under study and, as a rule, helped to identify the range of scientific journals of importance in particular fields. On the basis of the total

influence measure, Narin has advanced the principle of hierarchical structure of scientific periodicals within subject fields. Using JCR data for journals on human and medical genetics, A. Pudovkin and E. Garfield (Pudovkin, Garfield, 2002: 1113–1110) calculated their ‘relatedness factor’ (RF) of the leading periodicals in the field of Genetics.

The main goal of the present study is the bibliometric assessment of Russian journals of the mathematical sciences in the world and in the corpora of Russian scientific journals. Special attention in the present article is paid to the *Russian Journal of Mathematical Physics* (RJMP). Material for this study was drawn from **DBs ISI Web of Kowledge: Journal Citation Reports Science Edition** for the 1998–2010 periods (ISI Web of Knowledge: Journal Citation Reports: Science Edition, 2008–2010).

2. Normalization of the impact factor for the assessment of journals

The impact factor (Ip) given by JCR may be regarded a measure of the mean citedness of a journal. In the annual JCR databases it is calculated as follows: the sum of cites of the current year to publications of the given journal in the two preceding years is divided by the total number of publications in that journal during those two years. To take a concrete example, in 2010 RJMP got 112 cites to the journal’s articles published in 2009 and 2008. The total number of articles published in the journal in the years 2008 and 2009 was 49 and 50, respectively. Thus the impact factor is 112 / 99 = 1.131

Cites in 2010 to items published in:	2009 = 51	Number of items published in:	2009 = 49
	2008 = 61		2008 = 50
	Sum: 112		Sum: 99

Calculation: $\frac{\text{Cites to recentitems}}{\text{Number of recentitems}} = \frac{112}{99} = \mathbf{1.131}$

In the present study a special measure — the *normalized impact factor* (K) is also used. The JCR databases cover more than 170 fields of science and include about eight thousand scientific journals. It is well known that the level of citedness differs significantly across various fields of science: e.g. it is very high in biology and medicine and very low in mathematics or engineering. Therefore the traditional impact factor (Ip) of a journal, as it is indicated in JCR, would be valid only within large fields of science. To facilitate the cross-field evaluation of particular journals, the new measure K is introduced as follows: the Ip of a journal is divided by the *standard impact factor* (Ig) *of the field* to which this journal belongs. The technique of calculation of the standard impact factor for a field is an inherent part of the method and is of independent interest.

3. The standard impact factor for particular fields of science (Ig)

For each field of science, five journals with the highest Ip values were selected. If the total number of papers in those journals (for the two preceding years) was less than 500, the number of journals was extended until the threshold of 500 was reached. The ratio of the total number of citations (in JCR source journals) of articles in the selected journals to the total number of source items in those journals represents the field as a whole; it is called the *standard impact factor of the field* and is denoted by (Ig). As has been just mentioned, in the calculation of both Ip and Ig, the number (R) of current year citations is divided by the number of items (S) in the two preceding years.

The following is an example of the calculation of the standard impact factor (Ig) in the field of mathematics in 2009:

MATHEMATICS Ig = 3.06			
Ip	Journaltitle	ΣR	ΣS
4.174	ANN MATH	359	86
3.411	J AM MATH SOC	249	73
3.294	B AM MATH SOC	112	34
2.794	INVENT MATH	380	136
2.657	COMMUN PUR APPL MATH	271	102
2.619	ACTA MATH-DJURSHOLM	55	21
2.240	MEM AM MATH SOC	112	50

These calculated indicators may serve as a valuable addition to the JCR database. The standard impact factor Ig of a field can measure the rate of progress in that field. In science, fields with growing Ig might be called 'leading' fields. Below we follow the division of science into the research fields used in the JCR databases (the fields are called *categories* there).

4. Normalized impact factor of a journal

Once the standard impact factor of the field is obtained, the numerical assessment of a particular journal becomes evident. The most obvious and simple indicator is the ratio of the two measures:

K= (Ip / Ig) x 100%; this is the *normalized impact factor* of the journal.

If a journal belongs to two or more fields, then, instead of Ig, the arithmetic mean I'g of the two or more Ig's must be used I'g = (Igi + Igj + ... Ign) / n, where *n* is number of fields of science ("categories") in which the journal is indexed in the JCR databases. For example, in 2009 the journal *CHAOS SOLITON FRACT* (Ip = 3.315) was indexed in the three following JRC categories:

MATHEMATICS, INTERDISCIPLINARY APPLICATIONS (JCR code PO): Ig = 3.27
PHYSICS, MATHEMATICAL (UR): Ig = 2.67
PHYSICS, MULTIDISCIPLINARY (UI): Ig = 17.5

The arithmetic mean is I'g = 7.8, the normalized impact factor is K = (3.27 / 7.8)×100 = 42.5. We can write:

Abbr. Journal title	JCR Categories	I'g
CHAOS SOLITON FRACT	PO, UR, UI	7.8

In the next table, this journal is compared to some journals in mathematic and physics. This procedure was applied to the JCR database (Science Edition) for 2008–2010. The normalized impact factor (K) may prove to be a better measure of journal's impact than the traditional impact factor (Ip) of a scientific journal. The difference between the two factors in the evaluation of journals is striking. In 2009, the journals in the first two groups differ slightly in their Ip values (within the group), while the differences in K are sometimes astounding. On the other hand, the journals in the last two groups differ very much in their Ip values (JETP LETT + 1.66 and PMM-J APPL MATH MEC0.36), but are quite comparable as far as K (9.50 and 9.52) is concerned:

Abbr. Journal title	Ip	K
RUSS J MATH PHYS	0.85	31.8
THEOR MATH PHYS +	0.80	7.9
SIAM REV	3.39	109.7
CHAOS SOLITON FRACT	3.31	42.5
JETP LETT+	1.66	9.50
PMM-J APPL MATH MEC+	0.36	9.52
PHYS ATOM NUCL+	0.54	15.40
PHYS-USP+	2.63	15.02

(In this table and in the tables below, the plus sign (+) after the title of a Russian journal indicates that it is published both in English and Russian.) The standard impact factor for particular fields of science (Ig) and the normalized impact factor K were first introduced in 1988 to evaluate Soviet scientific periodicals. Without it, the cross-disciplinary comparison of periodicals is quite impossible, owing to the exceptionally great inter-field variance of the individual impact factors. This method was first published in the author's works in Russian (Marshakova, 1988) and later in English (Marshakova-Shaikevich, 1996: 283–290). The procedure was applied to the JCR database for 1992, then for 1998–2002 in (Marshakova-Shaikevich Irina and Heinz Michael, 2008: 37–45; Marshakova-Shaikevich, 2009). The normalized impact factor was used for the evaluation all social journals in **JCR databases (Social Science Edition)** for 1994–2004 by Drabek and Marshakova-Shaikevich (Drabek, Marshakova-Shaikevich, 2007: 88–104).

The normalized impact factor may be used as a standard indicator in forming particular databases. The financing of science in most countries demands great circumspection in the choice of scientific journals for subscription; the normalized measures Ig and K may be quite useful in this respect.

5. Dynamics of research fields of science

The annual calculation of the standard impact factor of particular fields (Ig) helps to monitor new tendencies in the development of science and to compare science policies of various nations. The analysis of the priority programs of the Russian ministry of science showed that in the period of *perestroika* (1985–1992) the list of programs was on the whole well correlated with the list of the most dynamic fields of world science; however, the share of financial support going to specific programs was in no way connected with the significance and dynamics of the corresponding field. Even with national priorities taken into account, the correlation between bibliometric indicators and financial support should not have been violated to such an extent. The impact factor of fields could be used in systems of grant distribution financed by national or international committee scientific programs (for example, RFBR).

An interesting aspect of the study of science is the analysis of the dynamics of Ig in particular categories. One should analyze the figures for specific categories, keeping in mind the growth of K for all categories in the period under consideration:

	1998–2002	2003–2005	2008–2009
I'g (average Ig)	3.77	4.83	5.60

The 50 per cent growth in a decade may be explained by social aspects of the present day situation: the Internet revolution in communications facilitates access to all sources of information; the lists of cited literature grow.

The dynamics of I'g (average Ig) for three cumulative periods 1998–2009 is shown in Table 1 for some fields of science and in Figure1 for four fields of the mathematical sciences, including the category *Physics, mathematical* (UR).

Table 1. I'g (average Ig) for some fields of science in 1998–2009

Code	JCR categories	Ig' (average Ig)		
		1998–2002	2003–2005	2008–2009
EX	COMPUTER SCIENCE, THEORY & METHODS	1.93	2.97	3.69
IF	ENGINEERING, MULTIDISCIPLINARY (Engineering)	1,29	1,97	3,36
MCB	MATHEMATICAL & COMPUTATIONAL BIOLOGY	—	—	4,34
PQ	MATHEMATICS	1,53	1,84	2,96
PN	MATHEMATICS, APPLIED	1,8	2,06	3,78
PO	MATHEMATICS, INTERDISCIPLINARY APPLICATIONS	1,49	5,06	3,29
PU	MECHANICS	2,26	2,93	4,91
PT	MEDICAL INFORMATICS	1,59	1,83	3,16
UR	PHYSICS, MATHEMATICAL	2,02	2,28	3,01
UI	PHYSICS, MULTIDISCIPLINARY	6,69	7,6	12,71
XY	STATISTICS & PROBABILITY	1,76	4,8	3,17

Table 2 and **Figure 2** present the standard impact factor of fields (Ig) for8 categories in the last period 2008–2010.

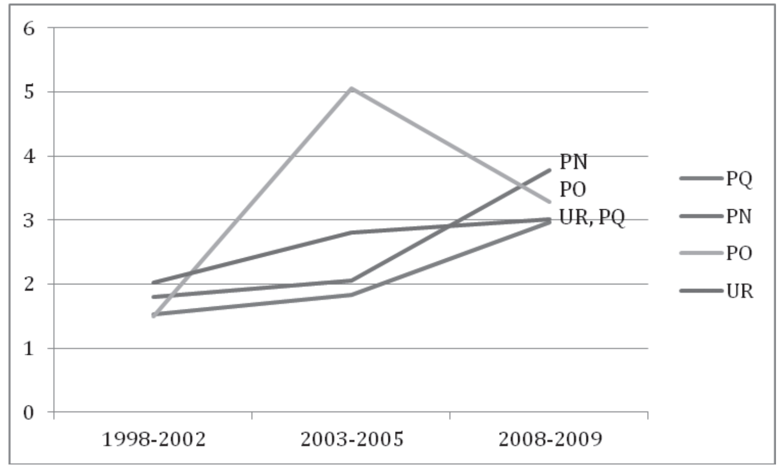

Fig.1. Dynamics of Ig' for four mathematical fields of science

Table 2. Standard impact factor of fields (Ig) for 8 categories in 2008–2010

JCR categories	JCR code	Ig 2008	Ig 2009	Ig 2010
COMPUTER SCIENCE, THEORY & METHODS	EX	3.90	3.47	3.42
STATISTICS & PROBABILITY	XY	2.91	3.42	2.99
MATHEMATICS	PQ	2.85	3.06	2.81
MATHEMATICS, APPLIED	PN	4.48	3.09	3.49
MATHEMATICS, INTERDISCIPLINARY APPLICATIONS	PO	3.32	3.27	4.94
PHYSICS, MATHEMATICAL	UR	3.36	2.67	2.42
MATHEMATICAL & COMPUTATIONAL BIOLOGY	MCB	4.27	4.41	4.17
MECHANICS	PU	5.34	4.48	4.04

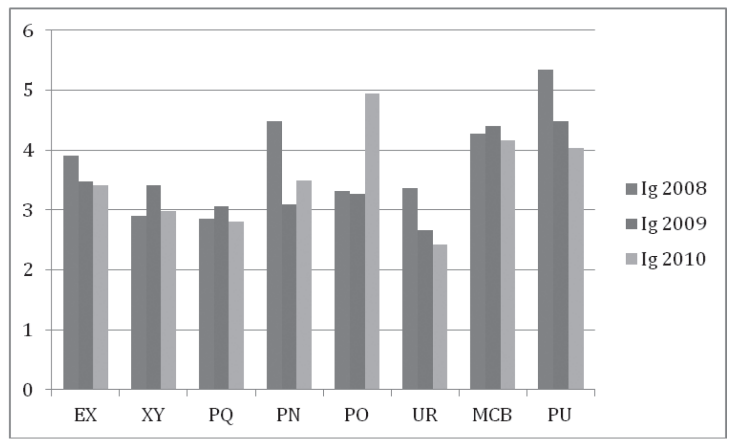

Fig.2. Dynamics of Ig in 2008–2010 for 8 categories

Table 2 shows the values of Ig in 4 mathematical categories: MATHEMATICS, APPLIED (JRC code PN), MATHEMATICS, INTERDISCIPLINARY APPLICATIONS (PO), MATHEMATICS (PQ), PHYSICS, MATHEMATICAL (UR) and 4 categories related tothem: COMPUTER SCIENCE, THEORY & METHODS (EX), STATISTICS & PROBABILITY (XY), MECHANICS (PU) and MATHEMATICAL & COMPUTATIONAL BIOLOGY (MCB).

The new category (MATHEMATICAL & COMPUTATIONAL BIOLOGY, Table 2) appeared in 2008. Only two of its journals are members of the new group and of no other, while 27 journals are included in other categories as well. From time to time the classification scheme of JCR is changed. As a rule a broad (often interdisciplinary) category is split into narrower categories. This is a common procedure in biomedicine. As far as mathematical journals are concerned, one can mention the split of the MATHEMATICS, APPLIED category. In 1982 it was divided into APPLIED MATHEMATICS proper and COMPUTER APPLICATIONS&CYBERNETICS. In the 1990s, the latter category constituted a broad field, which was ultimately split into seven categories of Computer Science:

ARTIFICIAL INTELLIGENCE (EP), CYBERNETICS (ER),
HARDWARE & ARCHITECTURE (ES),
INFORMATION SYSTEMS (ET), INTERDISCIPLINARY APPLICATIONS (EV),
SOFTWARE ENGINEERING (EW), THEORY & METHODS (EX).

Many mathematical journals indexed in the categories PQ, PN and PO have also become part of some categories of Computer Science. For example, ACM T MATH SOFTWARE (PN, EW), SIAM J COMPUT (PN, EX), J MATH IMAGING VIS (PN, EP, EW).

The calculated values of Ig do not depend on the number of journals in the field. Two large fields of knowledge, ENGINEERING, MULTIDISCIPLINARY and PHYSICS, MULTIDISCIPLINARY, have the same number of journals (79 and 71), but their values of Ig are quite different (3.17 and 17.5). Some other examples are given below:

JRC category	Number of journals	Ig 2009
COMPUTER SCIENCE, THEORY & METHODS	92	3.47
STATISTICS & PROBABILITY	100	3.42
MEDICAL INFORMATICS	23	3.31
ENGINEERING, MULTIDISCIPLINARY (Engineering)	79	3.17
MATHEMATICS	255	3.06
MATHEMATICS, APPLIED	204	3.09
MATHEMATICS, INTERDISCIPLINARY APPLICATIONS	80	3.27
PHYSICS, MATHEMATICAL	47	2.67
MATHEMATICAL & COMPUTATIONAL BIOLOGY	29	4.41
MECHANICS	123	4.48
PHYSICS, MULTIDISCIPLINARY	71	17.5

6. Bibliometric assessment of mathematical science journals in JCR for 2008–2009

This section is devoted to discussion of calculation results of the normalized impact factor K for 615 journals included in five categories: MATHEMATICS (PQ), MATHEMATICS, APPLIED (PN), MATHEMATICS, INTERDISCIPLINARY APPLICATIONS (PO), MATHEMATICAL & COMPUTATIONAL BIOLOGY (MCB), and PHYSICS, MATHEMATICAL (UR).

About a hundred journals belong simultaneously to two or more categories. Two journals are indexed in six categories:

Abbr. title of journal	Code category	Ip	K
J CHEMOMETR	**PO**, AC, EA, EP, OA, XY	1.291	33.79
OPEN SYST INF DYN	**UR**, DT, ET, PN, PU, XY	0.935	27.18

This practice is quite common in the new category MCB. Ofthe 29 journalsbelongingto MCB, only two journals are not indexed in any other category: 7 journals are covered in three categories, 3 journals, in four categories and 4 journals, in five categories. Thus the average number of categories per journals (ACJ) is 2.7. The multidisciplinary character of MCB is evident. One may expect further reclassification of the field. The PHYSICS, MATHEMATICAL

(UR) category is also highly multidisciplinary, its ACJ is 2.2.

The distribution of mathematical journals by values of K for 2009is given below:

ZONE	Values of Normalized impact factor K	Number of mathematical journals in fields				
		PN (204)	PO (80)	PQ (255)	UR (47)	MCB (29)
1	K > 100	4	1	1	1	0
2	100 < K > 50	27	9	12	17	2
3	< 50 K > 20	111	43	125	19	20
4	< 20 K > 10	56	20	99	6	4
5	< 10 K > 0	6	7	18	4	1
6	K= 0	0	0	0	0	0

Table 3 below includes 32 mathematical journals (PN, PO, PQ, and MCB) with K>50 ranked by normalized impact factor.

Table 3. Mathematical (PQ, PN, PO, MCB) journals with K > 50 (JCR database for 2009)

Rank	Abbreviated Journal Title	Code JCR category	Impact Factor	K 2009
1	INT J NONLIN SCI NUM	PN, PU, IF, UR	5.276	157.49
2	ANN MATH	PQ	4.174	136.40
3	ECONOMETRICA	PO, XY	4.000	119.76

4	SIAM REV	PN	3.391	109.74
5	B AM MATH SOC	PN	3.294	106.60
6	J AM MATH SOC	PN, EX	3.411	103.99
7	STRUCT EQU MODELING	PO	3.153	96.42
8	BMC SYST BIOL	MCB	4.064	92.15
9	INVENT MATH	PQ	2.794	91.31
10	COMMUN PUR APPL MATH	PQ, PN	2.657	86.55
11	ACTA MATH-DJURSHOLM	PQ	2.619	85.59
12	PLOS COMPUT BIOL	MCB, CO	5.759	85.57
13	BIOSTATISTICS	MCB, XY	3.246	83.23
14	SIAM J MATRIX ANAL A	PN	2.411	78.02
15	NONLINEAR ANAL-REAL	PN	2.381	77.05
16	MULTISCALE MODEL SIM	PO, UR	2.198	74.01
17	MEM AM MATH SOC	PQ	2.240	73.20
18	ABSTR APPL ANAL	PN	2.221	71.88
19	MULTIVAR BEHAV RES	PO, XY	2.328	69.70
20	STAT METHODS MED RES	MCB, HL, PT, XY	2.569	68.87
21	MATH MOD METH APPL S	PN	2.095	67.80
22	INVERSE PROBL	PN, UR	1.900	65.97
23	MATH PROGRAM	PN, EW, PE	2.048	65.22
24	APPL COMPUT HARMON A	PN, UR	1.854	64.37
25	FUZZY SET SYST	PN, XY, EX	2.138	64.20
26	INVERSE PROBL IMAG	PN, UR	1.831	63.57
27	FOUND COMPUT MATH	PQ, PN, EX	1.905	63.08
28	INT J NUMER METH ENG	PO, IF	2.025	62.89
29	CHAOS	PN, UR	1.795	62.33
30	SIAM J APPL DYN SYST	PN, UR	1.786	62.01
31	J CRYPTOL	PN, EX, IQ	2.297	61.42
32	ARCH RATION MECH AN	PO, PU	2.331	60.23

The 13 leading Russian journals in the same categories occupy very modest ranks (239-488) in this list (which contains 491 journals).

	RUSSIAN JOURNALS			
239	MOSC MATH J	PQ, PN	0.712	23.30
280	REGUL CHAOTIC DYN	PN, PU,UR	0.725	21.26
292	IZV MATH +	PQ	0.635	20.75
380	ALGEBR LOG+	PQ	0.479	15.65
385	RUSS J NUMER ANAL M	PN, IF	0.485	15.49
387	SIBERIAN MATH J +	PQ	0.475	15.47
413	RUSS MATH SURV +	PQ	0.425	13.88
440	PROBL INFORM TRANSM+	PM, EX	0.393	11.98
457	DIFF EQUAT+	PQ	0.339	11.08
458	MATH NOTES +	PQ	0.337	11.0
476	PMM-J APPL MATH MEC+	PN, PU	0.360	9.52
477	FUNCT ANAL APPL +	PQ PN	0.289	9.32
488	DOKL MATH	PQ	0.162	5.29

In the *Physics, mathematical* (UR) category, there were 47 journals in 2009. The ranking of the 18 journals which have of values K greater than 50 is presented in Table 4 below. Here again the ranks of the three leading Russian journals in that category (including the Russian Journal of Mathematical Physics) are quite modest.

Table 4. PHYSICS, MATHEMATICAL category journals in 2009

Rank	Abbreviated Journal Title	Code Ig	Impact Factor	K 2009
1	INT J NONLIN SCI NUM	UR, PN, PU, IF	5.276	157.49
2	COMMUN COMPUT PHYS	UR	2.077	77.79
3	COMMUN MATH PHYS	UR	2.067	77.41
4	QUANTUM INF COMPUT	UR, EX, UP	2.980	77.40
5	J STAT MECH-THEORY E	UR, PU	2.670	74.79
6	J COMPUT PHYS	UR, EV	2.369	74.26
7	MULTISCALE MODEL SIM	UR, PO	2.198	74.01
8	PHYS REV E	UR, UF	2.400	70.80
9	INVERSE PROBL	UR, PN	1.900	65.97
10	APPL COMPUT HARMON A	UR, PN	1.854	64.37
11	INVERSE PROBL IMAG	UR, PN	1.831	63.57
12	CHAOS	UR, PN	1.795	62.33
13	SIAM J APPL DYN SYST	UR, PN	1.786	62.01
14	COMPUT PHYS COMMUN	UR, EV	1.958	61.38
15	INT J GEOM METHODS M	UR	1.612	60.37
16	J NONLINEAR SCI	UR, PN, PU	1.816	53.25
17	J STAT PHYS	UR	1.390	52.06
18	ADV THEOR MATH PHYS	UR, UP	2.034	50.35
	RUSSIAN JOURNALS			
26	RUSS J MATH PHYS	UR	0.850	31.83
35	REGUL CHAOTIC DYN	UR, UP	0.725	21.26
44	THEOR MATH PHYS +	UR, UI	0.796	7.90

The geographical distribution of the 47 journals of the *Physics, mathematical* category is as follows: USA — 16, The Netherlands — 8, Singapore — 7, England — 6, Russia and Switzerland — 3, Germany, Poland, China and Ukraine — 1. Two Russian journals in this field — REGUL CHAOTIC DYN and RUSS J MATH PHYS are published only in English, THEOR MATH PHYS+ is published in Russian and translated into English.

7. Russian mathematical journals in the world corpus of scientific journals

In 2010[2] the Russian corpus of scientific journals included 147 journals (the corresponding figure for 2008 is 108, and for 2009, it is 123.In the list of Russian journals for 2010, there

[2] The JCR database (Science Edition) for 2010 has become accessible only in July 2011.

are 19 journals dealing with the mathematical sciences. Among them there are three new mathematical science journals:

COMPUTATIONAL MATHEMATICS AND MATHEMATICAL PHYSICS
(COMP MATH MATH PHYS+),
PROCEEDINGS OF THE STEKLOV INSTITUTE OF MATHEMATICS
(P STEKLOV I MATH),
ST PETERSBURG MATHEMATICAL JOURNAL (ST PETERSB MATH+).

Data on the19 journals in the mathematical sciences are presented in Table 5 below.

Table 5. Russian Mathematical Journals in JCR databases for 2008–2010

Journal abbreviation	Category code	2008		2009		2010	
		Ip	K	Ip	K	Ip	K
ALGEBR LOG+	PQ	—	—	0.479	15.65	0.455	16.19
COMP MATH MATH PHYS+	PN, UR	—	—	—	—	0.380	12.88
DIFF EQUAT+	PQ	0.437	15.33	0.339	11.08	0.369	13.13
DOKL MATH	PQ	0.222	7.79	0.162	5.29	0.204	7.26
FUNCT ANAL APPL +	PQ, PN	0.449	12.25	0.289	9.32	0.688	21.84
IZV MATH +	PQ	0.494	17.3	0.635	20.8	0.494	17.58
MATH NOTES +	PQ	0.270	9.5	0.337	11.0	0.344	12.24
MOSC MATH J	PQ, PN	—	—	0.712	23.3	0.721	22.89
P STEKLOV I MATH+	PQ, PN	—	—	—	—	0.276	8.76
PMM-J APPL MATH MEC+	PN, PU	0.348	7.09	0.360	9.52	0.352	9.36
PROBL INFORM TRANSM+	PM, EX	—	—	0.393	11.98	0.418	12.11
REGUL CHAOTIC DYN	PN, PU,UR	0.568	12.94	0.725	21.26	0.529	15.93
RUSS J MATH PHYS	UR	0.944	28.09	0.850	31.83	1.131	46.73
RUSS J NUMER ANAL M	PN, IF	0.305	7.60	0.485	15.49	0.592	18.97
RUSS MATH SURV +	PQ	0.430	15.08	0.425	13.9	0.496	17.65
SIBERIAN MATH J +	PQ	0.445	15.61	0.475	15.5	0.388	13.81
ST PETERSB MATH J+	PQ	—	—	—	—	0.347	12.35
THEOR MATH PHYS+	UR, UI	0.721	11.52	0.796	7.90	0.748	13.50
THEOR PROBAB APPL+	XY	0.698	23.97	0.827	24.18	0.318	10.63

The values of the standard impact factor Ig of some JCR categories in the mathematical sciences in 2008–2009 are shown in Table 6 below.

Table 6. Standard impact factor Ig for some JCR categories

Code	Categories in JCR	Standard impact factor		
		2008	2009	2010
EX	COMPUTER SCIENCE, THEORY & METHODS	3.90	3.47	3.42
IF	ENGINEERING, MULTIDISCIPLINARY (Engineering)	3.54	3.17	2.75
PN	MATHEMATICS, APPLIED	4.48	3.09	3.49
PO	MATHEMATICS, INTERDISCIPLINARY APPLICATIONS	3.32	3.27	4.94
PQ	MATHEMATICS	2.85	3.06	2.81
PU	MECHANICS	5.34	4.48	4.04
PT	MEDICAL INFORMATICS	3.01	3.31	2.69
UR	PHYSICS, MATHEMATICAL	3.36	2.67	2.42
UI	PHYSICS, MULTIDISCIPLINARY	9.16	15.50	8.66
XY	STATISTICS & PROBABILITY	2.91	3.42	2.99

The dynamics of the normalized impact factor K for Russian journals in the mathematical sciences for the three years 2008–2009–2010 are presented in Figure 3 below. Note that RJMP has the highest values of K and the rate of growth of its normalized impact factor is quite substantial.

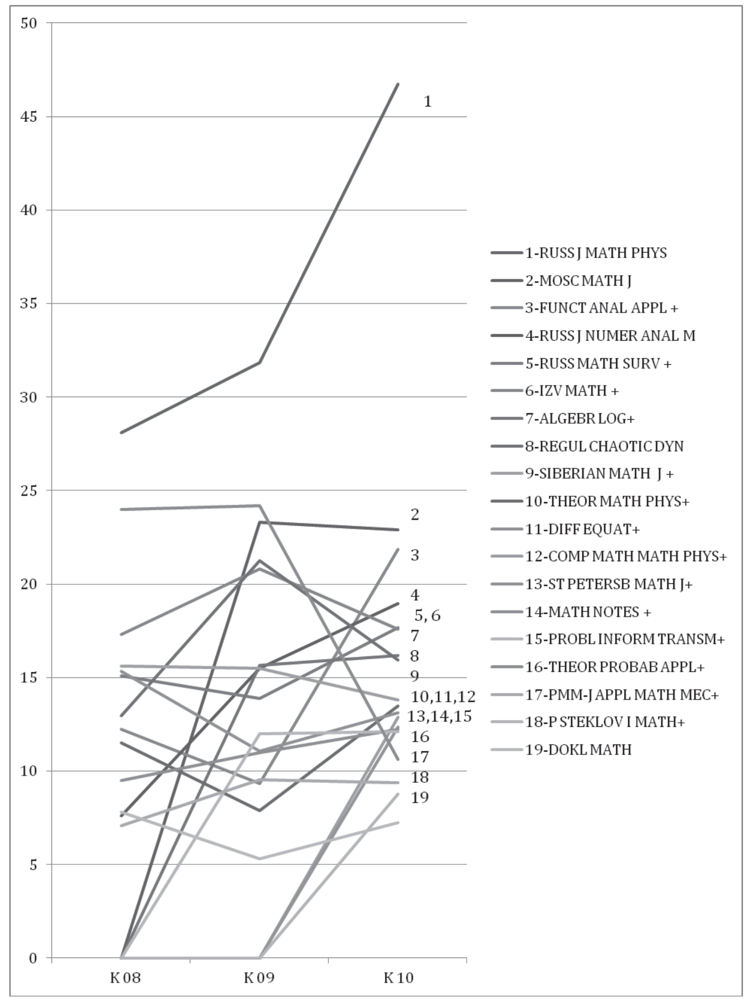

Fig. 3. Dynamics of K of the Russian journals in the mathematical sciences in 2008–2010

Let us examine changes in the values of the normalized impact factor K of Russian journals in the mathematical sciences in 2008, 2009 and 2010 (Fig. 3). We see that only three journals: RUSS J MATH PHYS, RUSS J NUMER ANALM and MATH NOTES+ had a stable growth of K; on the other hand, we see that two new journals: ALGEBR LOG+ and PROBL INFORM TRANSM+ had insignificant growth.

Figure 4 below shows the ranks of these journals according to their values of K in 2010.

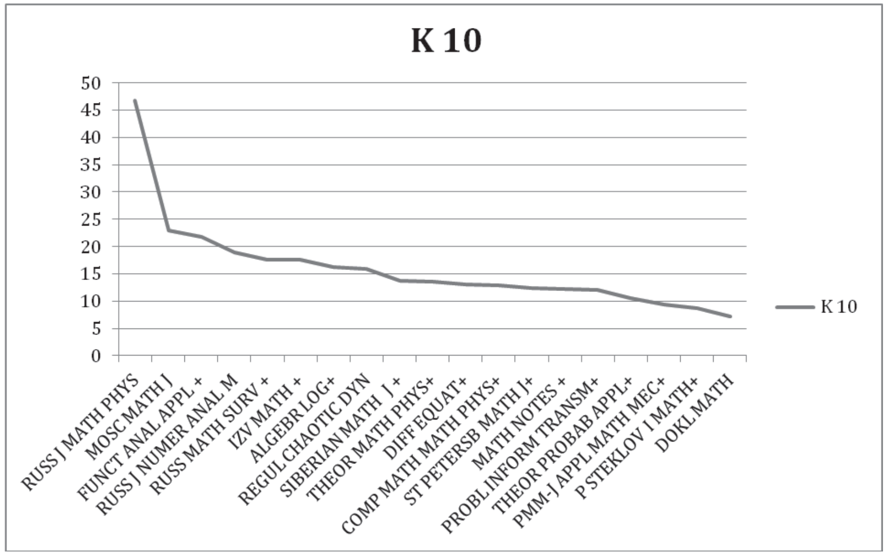

Fig. 4. Rankings by K of Russian journals in the mathematical sciences in 2010

This figure shows that only two journals have values of K between 20 and 40: RJMP and MOSC MATH J. Most Russian journals (14) have values of K between 10 and 20, while three have values of K less than 10.This is confirmed by Table 7 below, which also shows K', the average values of K in 2008–2010.This list is headed by three journals: RJMP, MOSC MATH J, and FUNCT ANAL APPL + with values of K in 2010 between 20 and 50.

Table 7. Normalized impact factor K (and its average K' for 2008–2010) for the same journals

Journal abbr.	K 08	K09	K10	Average K'
RUSS J MATH PHYS	28.09	31.83	46.73	35.55
MOSC MATH J	—	23.3	22.89	23.09
FUNCT ANAL APPL +	12.25	9.32	21.84	14.47
RUSS J NUMER ANAL M	7.60	15.49	18.97	14.02
RUSS MATH SURV +	15.08	13.9	17.65	15.54
IZV MATH +	17.3	20.8	17.58	18.56
ALGEBR LOG+	—	15.65	16.19	15.92
REGUL CHAOTIC DYN	12.94	21.26	15.93	16.71
SIBERIAN MATH J +	15.61	15.5	13.81	14.97
THEOR MATH PHYS+	11.52	7.90	13.50	10.97
DIFF EQUAT+	15.33	11.08	13.13	13.18
COMP MATH PHYS+	—	—	12.88	12.88
ST PETERSB MATH J+	—	—	12.35	12.35
MATH NOTES +	9.5	11.0	12.24	10.91
PROBL INFORM TRANSM+	—	11.98	12.11	12.04
THEOR PROBAB APPL+	23.97	24.18	10.63	19.59
PMM-J APPL MATH MEC+	7.09	9.52	9.36	8.66
P STEKLOV I MATH+	—	—	8.76	8.76
DOKL MATH	7.79	5.29	7.26	6.78

8. Russian mathematical journals in the national corpus of scientific journals

The rankings of 50 Russian scientific journals by impact factor Ip and by normalized impact factor K are presented in Tables 8 and 9.The leader of the journals in the mathematical sciences comes 13th in the Ip list (Table 8), yet among the 10 leaders in the list ranked by the normalized impact factor K (Table 9), we find five (!) mathematical journals with K more than 20. In these two tables, the journals in the mathematical sciences are displayed in bold font.

Table 8. Ranking of Russian scientific journals by impact factor Ip in 2009

Rank	Abbreviated Journal Title	Impact Factor	K 2009
1	PHYS-USP+	2.628	15.02
2	RUSS CHEM REV+	2.073	14.17
3	JETP LETT+	1.662	9.50
4	BIOCHEMISTRY-MOSCOW+	1.327	4.73
5	GEOTECTONICS+	1.000	23.64
6	RUSS GEOL GEOPHYS+	1.000	17.42
7	COMP CYTOGENET	0.973	5.03
8	ASTRON LETT+	0.943	12.12
9	PHYS PART NUCLEI+	0.935	17.28
10	STRATIGR GEO CORREL+	0.915	30.35
11	PETROLOGY+	0.912	15.89
12	J EXP THEOR PHYS+	0.871	5.62
13	RUSS J MATH PHYS	0.850	31.83
14	THEOR PROBAB APPL+	0.827	24.18
15	THEOR MATH PHYS+	0.796	7.90
16	QUANTUM ELECTRON+	0.791	10.37
17	MENDELEEV COMMUN	0.769	5.26
18	ASTRON REP+	0.759	9.75

19	J RUSS LASER RES	0.748	19.63
20	REGUL CHAOTIC DYN	0.725	21.26
21	ASTROPHYS BULL	0.723	9.29
22	PHYS SOLID STATE+	0.721	6.23
23	MOSC MATH J	0.712	23.19
24	KINET CATAL+	0.691	5.92
25	POLYM SCI SER A+	0.688	13.62
26	LASER PHYS	0.676	9.37
27	APPL BIOCHEM MICRO+	0.670	4.40
28	LOW TEMP PHYS+	0.662	6.23
29	MICROBIOLOGY+	0.638	4.55
30	SEMICONDUCTORS+	0.637	5.50
31	IZV MATH+	0.635	20.75
32	RUSS J COORD CHEM+	0.605	12.52
33	PALEONTOL J+	0.604	20.68
34	J ANAL CHEM+	0.604	13.16
35	COLLOID J+	0.588	5.04
36	PLASMA PHYS REP+	0.584	14.17
37	TECH PHYS LETT+	0.580	5.46
38	HIGH TEMP+	0.578	5.44
39	MOL BIOL+	0.570	2.03
40	CRYSTALLOGR REP+	0.559	9.24
41	REV ADV MATER SCI	0.558	3.14
42	COMBUST EXPLO SHOCK+	0.547	6.81
43	PHYS ATOM NUCL+	0.539	15.40
44	ACOUST PHYS+	0.534	22.44
45	RUSS J ORG CHEM+	0.525	9.46
46	OPT SPECTROSC+	0.505	13.25
47	GEOCHEM INT+	0.502	11.87
48	RUSS J GENET+	0.501	2.59
49	RUSS J PLANT PHYSL+	0.500	4.80
50	HIGH ENERG CHEM+	0.498	4.27

The ranking of the same journals according to K looks quite different.

Table 9. Ranking by K of Russian scientific journals in 2009

Rank	Abbreviated Journal Title	Impact Factor	K 2009
1	RUSS J MATH PHYS	0.850	31.83
2	STRATIGR GEO CORREL+	0.915	30.35
3	THEOR PROBAB APPL+	0.827	24.18
4	GEOTECTONICS+	1.000	23.64
5	MOSC MATH J	0.712	23.19
6	ACOUST PHYS+	0.534	22.44
7	REGUL CHAOTIC DYN	0.725	21.26
8	IZV MATH+	0.635	20.75
9	PALEONTOL J+	0.604	20.68
10	J MIN SCI+	0.352	20.00
11	J RUSS LASER RES	0.748	19.63
12	PHYS MET METALLOGR+	0.477	18.42
13	RUSS GEOL GEOPHYS+	1.000	17.42
14	PHYS PART NUCLEI+	0.935	17.28
15	PETROLOGY+	0.912	15.89
16	ALGEBR LOG+	0.479	15.65
17	SIBERIAN MATH J+	0.475	15.52
18	RUSS J NUMER ANAL M	0.485	15.49
19	PHYS ATOM NUCL+	0.539	15.40
20	PHYS-USP+	2.628	15.02
21	PLASMA PHYS REP+	0.584	14.17
22	RUSS CHEM REV+	2.073	14.17
23	RUSS MATH SURV+	0.425	13.89
24	POLYM SCI SER A+	0.688	13.62
25	PROT MET+	0.347	13.40
26	OPT SPECTROSC+	0.505	13.25
27	J ANAL CHEM+	0.604	13.16
28	RUSS J COORD CHEM+	0.605	12.52
29	ASTRON LETT+	0.943	12.12
30	PROBL INFORM TRANSM+	0.393	11.98
31	GEOCHEM INT+	0.502	11.87
32	DIFF EQUAT+	0.339	11.08
33	MATH NOTES+	0.337	11.01
34	GEOL ORE DEPOSIT+	0.331	10.47
35	QUANTUM ELECTRON+	0.791	10.37
36	RUSS J NONDESTRUCT+	0.195	10.37
37	RUSS J MAR BIOL+	0.346	10.12
38	ASTRON REP+	0.759	9.75
39	INSTRUM EXP TECH+	0.331	9.54
40	PMM-J APPL MATH MEC+	0.360	9.52
41	JETP LETT+	1.662	9.50
42	RUSS J ORG CHEM+	0.525	9.46
43	FUNCT ANAL APPL+	0.289	9.41
44	LASER PHYS	0.676	9.37
45	ASTROPHYS BULL	0.723	9.29
46	RUSS J ELECTROCHEM+	0.347	9.25
47	CRYSTALLOGR REP+	0.559	9.24
48	J VOLCANOL SEISMOL+	0.386	9.12
49	IZV ATMOS OCEAN PHY+	0.371	9.09
50	OCEANOLOGY+	0.307	8.95

It is interesting to compare the ranks of journals by the normalized impact factor K for K > 15 and by the impact factor Ip (Table 10below). The two well-known journals JETP LETT and J EXP THEOR PHYS do not appear in this table, because they have smaller values of K (9.50 and 5.62, respectively). Their ranks by K are 41 and 67 in the Russian national corpus.

Table 10. Ranks by K and by Ip of Russian scientific journals with K > 15

Rank by K	Russian journals JCR:2009SE	Ip	K 2009	Rank by Ip 2009
1	RUSS J MATH PHYS	0.850	31.83	13
2	STRATIGR GEO CORREL+	0.915	30.35	10
3	THEOR PROBAB APPL+	0.827	24.18	14
4	GEOTECTONICS+	1.000	23.64	5.5
5	MOSC MATH J	0.712	23.19	23
6	ACOUST PHYS+	0.534	22.44	5
7	REGUL CHAOTIC DYN	0.725	21.26	22
8	IZV MATH+	0.635	20.75	31
9	PALEONTOL J+	0.604	20.68	33.5
10	J MIN SCI+	0.352	20.00	71
11	J RUSS LASER RES	0.748	19.63	19
12	PHYS MET METALLOGR+	0.477	18.42	54
13	RUSS GEOL GEOPHYS+	1.000	17.42	5.5
14	PHYS PART NUCLEI+	0.935	17.28	9
15	PETROLOGY+	0.912	15.89	11
16	ALGEBR LOG+	0.479	15.65	53
17	SIBERIAN MATH J+	0.475	15.52	55
18	RUSS J NUMER ANAL M	0.485	15.49	52
19	PHYS ATOM NUCL+	0.539	15.40	**43**
20	PHYS-USP+	2.628	15.02	**1**

Further, it is interesting to compare the bibliometric indicators (and ranks) off our Russian journals from the *Physics, Mathematical* (UR) category with the two Russian journals, J EXP THEOR PHYS+ and JETP LETT + from the *Physics, Multidisciplinary* (UI) category (Table 11).

Table 11. Bibliometric indicators for 6 Russian journals: 2008–2010

Journal abbr	Category code	2008		2009		2010	
		Ip	K	Ip	K	Ip	K
COMP MATH MATH PHYS+	PN, UR	—	—	—	—	0.380	12.88
REGUL CHAOTIC DYN	PN, PU,UR	0.568	12.94	0.725	21.26	0.529	15.93
RUSS J MATH PHYS	UR	0.944	28.09	0.850	31.83	1.131	46.73
THEOR MATH PHYS+	UR, UI	0.721	11.52	0.796	7.90	0.748	13.50
J EXP THEOR PHYS+	UI	0.892	9.74	0.871	4.98	0.946	10.92
JETP LETT +	UI	1.418	15.48	1.662	9.5	1.557	17.98

We see that in 2010 RJMP is in first place among six Russian journals in the physical fields. The journal JETP LETT is in second place in 2008 and 2010 by values K.

In Figure 8 below, we show the dynamics of the values of the normalized impact factor K for the same six Russian journals in the physical sciences.

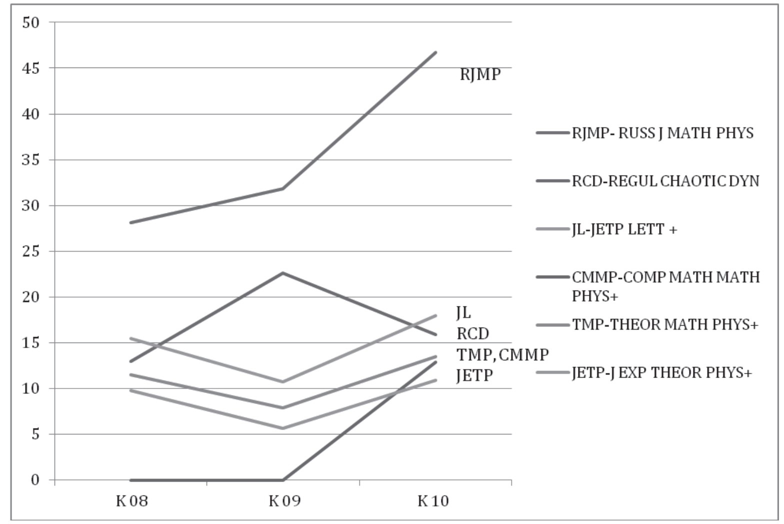

Fig. 8. Dynamics of the normalized impact factor K for six Russian physics journals

Thus Figures 3 and 8, together with Table 10, show that RJMP is in first place by normalized impact factor K not only among Russian journals in the physical and mathematical sciences, but also among all the Russian scientific journals appearing in the JCR databases in 2008-2010.

In conclusion of this section, it is interesting to compare, on the one hand, the ranks of five important physics journals indexed in the categories *Physics, Mathematical* (UR) and *Physics, Multidisciplinary* (UI) (by two bibliometric indicators: the normalized impact factor K and the impact factor Ip) in the entire Russian scientific corpus (123 journals) with, on the other hand, the ranks of those journals in the appropriate categories by the impact factor Ip from the JCR database for 2009 (Table 12).

Table 12. Bibliometric indicators for 6 Russian journals: 2009

Abbr. journal title	K	Ip	Rank in Russian national corpus (123 journals)		Rank in category UR (47 journals)	Rank in category UI (71 journals)
			by K	byIp	byIp	byIp
RUSS J MATH PHYS	31.83	0.850	1	**13**	**33**	**—**
REGUL CHAOTIC DYN	22.60	0.725	7	20	37	—
JETP LETT +	9.50	1.662	41	3	—	24
THEOR MATH PHYS+	7.90	0.796	53	15	34	—
J EXP THEOR PHYS+	5.62	0.871	67	12	—	40

9. The citations of V. I. Arnold

To conclude this study, the author would like to analyze the citations of the work of the famous Russian mathematician Vladimir Arnold, to whom this article is dedicated. We present the citation of V. I. Arnold in the period 1945-2011 below.

The JCR database Web of Science (ISI Web of Science: 1945–2011) includes 3248 cites to Arnold's publications in a total of 2012 records (documents). We analyze cites by (1) categories, (2) countries, and (3) authors.

(1) References to Arnold appear in 29 Web of Science categories, but more than 50 % of them are in the following 9 categories:

MATHEMATICS (562)
MATHEMATICS APPLIED (468)
PHYSICS, MATHEMATICAL (364)
PHYSICS MULTIDISCIPLINARY (312)
MECHANICS (245)
PHYSICS FLUIDS PLASMAS (130)
MULTIDISCIPLINARY SCIENCES (95)
MATHEMATICS INTERDISCIPLINARY APPLICATIONS (83)
ASTRONOMY ASTROPHYSICS (74)

(2)Almost one fourth of the references to Arnold are from the USA (507), Russia holds second place with 290 cites, with France (241), England (156), USSR (104), Germany (102), Canada (90), Italy (85), China (71), Israel (59) and others. Total statistics by countries shows that references to Arnold's papers were done by authors from 57 countries.

(3) The 2012 cites to Arnold belong to 742 authors, 29 of them cited Arnold in more than seven publications:

Authors	Record-Count	% of 2012	Authors	Record-Count	% of 2012
MARSDEN JE	28	1.392	GLASS L	8	0.398
HOLM DD	24	1.193	GUCKENHEIMER J	8	0.398
SHEPHERD TG	22	1.093	MAHALOV A	8	0.398
ARNOLD VI	18	0.895	NICOLAENKO B	8	0.398
MOSEKILDE E	15	0.746	SAGDEEV RZ	8	0.398
GRAMMATICOS B	13	0.646	SPERL M	8	0.398
RAMANI A	13	0.646	VLADIMIROV VA	8	0.398
RATIU TS	12	0.596	BRENIER Y	7	0.348
GOTZE W	11	0.547	GAETA G	7	0.348
IEEE	11	0.547	KARPENKOV ON	7	0.348
JANECZKO S	11	0.547	KHESIN B	7	0.348
CHERNIKOV AA	10	0.497	KOZLOV VV	7	0.348
CHERNIKOV AA	10	0.497	KRAUSKOPF B	7	0.348
MU M	10	0.497	MARCHIORO C	7	0.348
CHIRIKOV BV	9	0.447	OSINGA HM	7	0.348
MARMI S	9	0.447	PUTA M	7	0.348
ZASLAVSKY GM	9	0.447	RATIU T	7	0.348
			SOSNOVTSEVA OV	7	0.348

Conclusion

1. The bibliometric analysis of scientific journals, based on the JCR databases, shows that the impact factor of fields of science (Ig) is growing in science as a whole. The growth of the number of citations is due both to the progress of science proper and of the means of communication facilitating access to information.

2. The normalized impact factor (K) is a tool for the comparison of journals across fields of knowledge, and it is very important in assessing national contributions to world science.

3. The traditional impact factor (Ip) favors such disciplines as biology and medicine and can hardly be used in reference to fields with lower level of citedness (such as mathematics or technology). The introductions of the normalized impact factor K will help remedy that injustice.

4. The bibliometric analysis of Russian mathematical journals shows that they occupy only a modest place in the world list of 609 mathematical journals (see Tables 3 and 4). However, within the national Russian corpus of scientific journals, they fare much better. Measured by the normalized impact factor, eight mathematical journals (RJMP, THEORPROBABAPPL+, MOSCMATHJ, REGULCHAOTICDYN, ALGEBRLOG+, SIBERIANMATHJ+, RUSSJNUMERANALM) appear among the twenty leaders of the list of 140 journals. In 2009 and 2010, the list is headed by the Russian Journal of Mathematical Physics, published in English by MAIKNAUKA/ INTERPERIODICA/SPRINGER.

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References

Drabek A., Marshakova-Shaikevich I. (2007). Bibliometric Assessment of Scientific Journals from DBs JCR Social Science Edition // Book of Papers of Third International Conference on Webometrics, Informetrics, Scientometrics and Science and Society and Eighth COLLNET Meeting, COLLNET 2007, March 6–9, 2007. New Delhi: Sonu Printing Press Pvt. Ltd. P. 88–104.

Garfield E. (2006). The History and Meaning of the Journal Impact Factor // Journal of the American Medical Association (JAMA), (293): P. 90–93. January. URL: http://garfield.library.upenn.edu/papers/jamajif2006.pdf

Hirst G. (1978). Discipline impact factors: A method for determining core journal list // Journal of the American Societies for Information Science. Vol. 29. P. 171–172.

ISI Web of Knowledge: Journal Citation Reports: Science Edition 2008–2010

ISI Web of Science: 1945–2011 (27.08)

Marshakova I. V. (1988) The SCI system as a means of monitoring science development. Moscow: Nauka. 288 p. (in Russian).

Marshakova-Shaikevich I. (1996) The standard impact factor as an evaluation tool of science fields and scientific journals // Scientometrics. Vol. 35. № 2. P. 283–290.

Marshakova-Shaikevich I. V. (2008). Russia in World Science. Moscow: Inst. Philosophy RAS. 228 p. (in Russian).

Marshakova-Shaikevich I. (2009). Quantitative analysis of science: bibliometric and webometric approach. Uniw. AM, Poznan. 292 p. (in Polish).

Marshakova-Shaikevich I. and Heinz M. (2008). Journal ranking of world scientific corpus by Normalized impact factor // Collnet Journal of Scientometrics and Information Management.Vol. 2. № 2. 2008. December. P. 37–45.

Narin F., Pinsski G., Gee H. H. (1976) Structure of the biomedical literature // Journal of the American Society for Information Science. Vol. 27. P. 25–46.

Pudovkin A. I., Garfield E. (2002) Algorithmic Procedure for finding semantically related journals // JASIST. Vol. 53 (13). P. 1113–1110.

Scientometrics Guidebook Series (2007). Vol. 2. The Impact Factor of Scientific and Scholarly Journals. Its Use and Misuse.

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Creating Linkages: Government Policy to Stimulate R&D through University-Industry Cooperation in Russia

The article analyzes new government measures aimed at the creation of linkages between universities and companies in Russia to strengthen R&D and make them more effective in terms of practical applications. Three measures are assessed — programs of innovation development of large government-controlled companies, technology platforms, and cooperative R&D projects. It is shown that all measures are important and interconnected though there are some flaws in their implementation. At the same time application of these measures caused a number of positive side effects for Russian R&D complex.

Keywords: R&D, universities, companies, financing, workforce, technology platforms, programs of innovative development, joint R&D projects

State of R&D in Russia

The R&D complex inherited to a large extent Soviet traditions and organization. It is still highly hierarchical, and centralized. The federal government dominates both in terms of financing and control over organizations involved in R&D. Federal budget is the major source of support for R&D in Russia and the share of federal budget among the sources of support is increasing while business plays an insufficient role in financing R&D. Moreover, government in a way substitutes private funds creating in this way disincentives for business. All these characteristics are especially noticeable from international perspective (tables 1 and 2).

Table 1

Gross Domestic Expenditures on R&D Financed by Government and Industry, in % of Total Gross Expenditure on R&D

Country	Business enterprises		Government	
	2005	2010	2005	2010
United States (1)	64.3	61.8	30.2	27.3
Japan (2)	76.1	78.2	16.8	15.6
Germany	67.6	66.1	28.4	29.7
France	51.9	52.4	38.6	38.6
United Kingdom	42.1	44.5	32.7	32.6
European Area (17 countries)	56.1	55.7	35.4	35.4
Russia	22.4	18.3	60.1	68.8

(1) Data for 2009
(2) Data for 2008
Sources: (EUROSTAT, 2011); (Science and Engineering Indicators, 2012: 254); (Nauka, technologii i innovatsii Rossii: 2009: 25); (Nauka, technologii i innovatsii Rossii: 2011: 31)

As it may be seen from the data presented in table 1, the share of business in financing R&D in most of the developed countries is high — over 50 % average — and was growing over years. In Russia, in opposite, the share of federal government is excessively high and has grown by 9 % for the last 5-year period, reaching almost 70 % of the total intramural expenditures on R&D.

Government participation in financing R&D in the business sector in Russia is also unprecedented — it is close to 60 % while the average for OECD countries is about 7 % (table 2).

Table 2

Percentage of Business Enterprise Expenditure on R&D Financed by Government

Country	2005	2006	2007	2008	2009
United States	9.7	9.8	9.9	8.9	14.0
Japan	1.2	1.0	1.1	0.9	—
Germany	4.5	4.5	4.5	4.5	4.5
France	10.1	11.3	9.8	11.4	—
United Kingdom	8.3	7.6	6.8	6.6	6.6
Total OECD countries	6.8	6.8	6.8	6.5	—
Russia	53.6	52.0	55.3	56.0	57.4

Sources: (OECD,2010: 59); (Science and Engineering Indicators, 2012: 238)

Another specific feature of the Russian R&D complex is low and decreasing support for R&D from abroad. The share of financing from abroad in the total expenditures on R&D is 8.4 % for OECD countries in average (data for 2009), with variations from 3.8 % in Germany to 16.6 % in UK (EUROSTAT, 2011). In Russia it is 3.5 % (data for 2010) (Nauka, technologii i innovatsii Rossii: 2011: 31). This indicates that foreign financing in the form