

# The space of scientific collaboration of 15 ‘old ‘ and 10 ‘new’ EU countries in the field of social sciences.

IRINA MARSHAKOVA-SHAIKEVICH

Adam Mickiewicz University, Poznan, POLAND  
The Institute of Philosophy RAN, Moscow, RUSSIA  
e-mail: ishaikev@mail.ru

## *Abstract*

The paper presents bibliometric analysis of scientific collaboration of 15 ‘old’ and 10 ‘new’ countries EU in the field of social sciences. Material for this analysis was drawn from DB SSCI 2002. The states as wholes are considered here as participants of collaboration. Coefficients of collaboration relatedness between pairs of countries form a space reflected in two tables, one for 15 ‘old’ EU member-states and in the other for 10 ‘new’ EU member-states.

## *1. Introduction*

Scientific collaboration is becoming a significant issue in bibliometric and webometric studies of science. During the last decades a large number of those studies have been presented. International collaboration in the sciences, 1981-1985 was discussed by Shubert and Braun [1], Narin et al.[2] was studied scientific co-operation in Europe, Lamirel et al. [3] presented a new approach for evaluation of collaboration between European universities. Regional collaboration in science & technology among South Asian countries was studied by Gupta et al. [4], scientific collaboration between immunology institutions including aspects of gender studies was presented by Krestchmer et al.[5].

This paper presents bibliometric analysis of scientific collaboration of 15 ‘old’ and 10 ‘new’ countries EU in the field of social sciences. The object of the paper is the joint publications of authors from the 25 EU member-states in the field of social sciences. Material for this analysis was drawn from DB SSCI 2002 [6]. The states as wholes are considered here as participants of collaboration. If a paper has two or more authors from different countries, it belongs to the material of the present study. In SSCI

DB there are 1060 publications, whose authors' addresses were in would-be new member-states of EU and 34103 publications, whose authors' addresses were in 'old' member-states of EU.

### *Research Activity and Citation Statistics*

According to NSI [7] Standard version: 1998-2002 saw 3 599 665 papers in the fields of science and social science published with USA as world leader contributing 34.17 per cent of publication. The scientists from 15 EU member-states authored 37.13 per cent of all papers, the share of the ten EU candidate-countries is 2.99 per cent (more than 107 thousand papers), which is roughly equal to that of the 32 countries of Latin America (3.16 per cent of all countries or more than 113 thousand papers).

The cited papers constitute 59.87 per cent of all papers in NSI DB and 63.15 per cent of all papers in EU Countries. The corresponding figures of the 15 EU countries, except Greece, are higher – from 69.2 (Denmark) to 57.92 (Portugal). As for 10 EU candidate countries they vary little around the average figure in DB NSI (except Slovakia and Malta) and much lower than average figure for 15 EU countries. To some extent lesser citedness is due to language barriers, but the primary factor is quality of the work. Both quality and quantity of scientific production is reflected in the total number of citation of papers from this or that country.

The 'Citation Impact' is the ration of number of citation to the number of publications. The measure is effective as a tool of differentiation of both single countries and organizations. The average figure of Citation Impact in DB NSI is 4.25 and 4.54 for EU countries. The most significant differences among 15 EU countries are Netherlands, Denmark, UK and Sweden with higher Citation Impact and all 10 EU candidate-countries – with low Citation Impact less than 2.75; only two countries Estonia (the former USSR country) and Hungary exceed the figure at 3.

Research Activity and Citation statistics in science and social science for period 1998-2002 for those countries is shown in table 1.

Table 1 DB NSI Standard version:1998-2002

	COUNTRIES	% of world total	Number of Papers	% cited papers	Citation Impact
EU Countries					
1	UK	9.30	334676	64.98	5.25
2	GERMANY	8.82	317370	63.95	4.97
3	FRANCE	6.34	228185	62.82	4.66
4	ITALY	4.18	150417	63.01	4.61
5	SPAIN	2.95	106115	61.12	3.84
6	NETHERLANDS	2.56	92220	67.97	5.71
7	SWEDEN	2.05	73644	67.79	5.17
8	BELGIUM	1.35	48572	65.10	4.94
9	DENMARK	1.04	37609	69.17	5.58

10	FINLAND	0.98	35259	65.92	4.92
11	AUSTRIA	0.95	34156	62.63	4.57
12	GREECE	0.66	23668	54.80	2.78
13	PORTUGAL	0.42	15008	57.92	3.19
14	IRELAND	0.36	12975	59.67	4.19
15	LUXEMBOURG	0.01	440	61.59	3.49
EU candidate-countries					
1	POLAND	1.26	45325	53.60	2.54
2	CZECH REP	0.57	20398	54.30	2.67
3	HUNGARY	0.52	18874	57.53	3.22
4	SLOVAKIA	0.25	9102	50.20	2.27
5	SLOVENIA	0.17	6276	52.17	2.51
6	ESTONIA	0.08	2700	59.33	3.38
7	LITHUANIA	0.06	2287	51.12	2.74
8	LATVIA	0.05	1638	51.28	2.52
9	CYPRUS	0.02	692	51.16	2.49
10	MALTA	0.01	210	49.05	2.74

*Research Cooperation in the social sciences :results of study.*

In social sciences research activity is much lower than in science, e.g. in 2002 England had 13112 publications, Germany 4762, France 2363, Italy 1505 (see table 2).

Table 2 Research activity of some UE countries

Countries	2002	
	SCI	SSCI
UK		
- England	69838	13112
- Scotland	10559	1427
- Wales	5872	756
- North Ireland	1637	290
Germany	74555	4762
France	52150	2363
Italy	38071	1505
Spain	26942	1402
Netherlands	21460	2958
Sweden	16771	1673
Poland	12074	198
Belgium	11689	799
Denmark	8996	831
Austria	8597	517

Finland	8005	818
Grece	6192	320

Total statistics of research activity and research cooperation of the 10 new member-states is given in table 3.

Table 3 Total Statistics of COLLABORATION of 10 New UE Countries

10 NEW Countries EU	Total publications	Collaboration publications	% collaboration publications	Number of collaborating countries
CZECH-REP	301	74	24.6	21
POLAND	198	108	54.5	26
HUNGARY	196	122	62.2	25
SLOVAKIA	132	14	10.6	6
SLOVENIA	84	39	46.4	21
ESTONIA	52	24	46.1	12
CYPRUS	45	26	57.8	13
LITHUANIA	34	12	35.3	7
MALTA	13	7	53.8	4
LATVIA	5	3	60	3
Total	1060	429		

The per cent of joint publications of 10 'new' counties is very high, the only exception is two states of former Czechoslovakia. As might be expected about 70 per cent of all joint papers published in English, second comes Czech – 20 per cent, third place goes to Slovakian (nearly 7 per cent).

The 10 new EU candidate-countries in 2002 collaborated mostly with 15 EU countries and USA. Scientific collaboration between these countries are 73 per cent of all joint publications. The statistics of joint publications of the countries under study are given in table 4.

Table 4 COLLABORATION of 10 New EUCountries

Countries	CzR	PL	Hu	SK	SL	ES	CY	LI	MA	LA	Total
<b>Total</b>	74	107	122	14	39	24	26	12	7	3	429
Austria	2	3	3		1						9
Belgium	1	3	3		2	1					10
Denmark	3	1	1		1			2		1	9
Finland	1	1	6			2	1	1			12
France	4	5	4		1	1			1		16
<b>Germany</b>	<b>10</b>	<b>15</b>	<b>13</b>	<b>3</b>	<b>2</b>			<b>1</b>			<b>44</b>

Greece					1		4				5
Ireland											
Italy	3	1			3		1				8
Luxembourg											
Netherlands	3	9	9		2						23
Portugal					1						1
Spain	2	1	3		4			1			11
Sweden	2	2	2		3	4					13
UK											55
<b>England</b>	<b>7</b>	<b>7</b>	<b>12</b>	<b>4</b>	<b>4</b>	<b>1</b>	<b>3</b>	<b>4</b>	<b>3</b>	<b>1</b>	<b>46</b>
N-Ireland								2			2
Scotland		2	4								6
Wales							1				1
<i>CzR</i>		3		2							5
<i>PL</i>	3		6	1		1					11
<i>Hu</i>	3	6				1					10
<i>SK</i>					2						2
<i>SL</i>	2			2							4
<i>ES</i>		1	1								2
<b>USA</b>	<b>21</b>	<b>30</b>	<b>34</b>		<b>3</b>	<b>6</b>	<b>4</b>		<b>2</b>	<b>1</b>	<b>101</b>
Australia	2	2	2						1		7
Canada	1	1	4				5				11
Russia		5	5			3	2	1			16
Croatia	1	1		2	4						8
Israel		2	3								5
Japan		2	1		1	1					5
Norway	1				1	2					4
Switzerland		1	1		1						3
Iceland	1				1						2
R-China		1			1						2
R-Georgia			1			1					2
Ethiopia			1								1
Romania			1								1
S-Korea		1									1
S-Afrika		1									1
Bulgaria	1										1
Brazil			1								1
Iran			1								1
Jordan							1				1
Lebanon							1				1
Morocco							1				1
Syria							1				1
Tunisia							1				1

Total statistics of collaboration of 15 'old'EU countries is given in table 5.

Table 5 Total statistics of collaboration of 15 'old' EU countries

COUNTRIES	Collaboration publication		Collaboration with 15 'old' EU countries		
	Total Publication	number of publications	% of publications	Number of publication	% of publications
UK	15585	3725	23.9	2157	13.8
England	13112	2873	21.9	1547	11.8
Scotland	1427	477	33.4	336	23.6
Wales	756	294	38.9	213	28.2
North Ireland	290	81	27.9	61	21.0
Germany	4762	1305	27.4	720	15.1
Netherlands	2958	1096	37.0	650	22.2
France	2363	806	34.1	422	17.9
Sweden	1673	528	31.6	300	18.0
Italy	1505	687	45.6	406	27.0
Spain	1402	485	34.6	304	21.7
Denmark	831	441	53.1	317	38.1
Finland	818	323	39.5	177	21.6
Belgium	799	460	57.6	315	39.4
Austria	517	236	45.6	143	27.6
Ireland	407	174	42.8	136	33.4
Grece	320	117	36.6	86	26.9
Portugal	156	94	60.2	66	42.3
Luxemburg	7	3	42.9	3	42.9

6. The statistics of joint publications of the countries under study are given in table

Table 6 The statistics of joint publications of 15 'old' EU countries

Country	AU	BE	DE	FI	FR	GE	GR	IR	IT	LU	NE	PR	SP	SW	En	Sc	W	N-Ir
AU	xx	6	9	0	7	60	0	2	8	0	14	1	4	4	19	6	2	1
BE		xx	5	3	61	28	2	3	18	0	96	5	23	6	74	5	0	0
DE			xx	22	9	30	0	5	12	0	31	0	6	38	140	7	2	1
FI				xx	7	24	2	1	5	0	12	0	9	42	44	2	2	2
FR					xx	63	6	3	53	0	32	7	38	27	99	7	1	2
GE						xx	5	6	58	2	110	4	46	39	208	31	6	0
GR							xx	1	5	0	6	3	4	1	42	7	1	1
IR								xx	8	0	16	2	3	2	63	5	4	12
IT									xx	1	53	2	26	16	116	21	4	0
LU										xx	0	0	0	0	0	0	0	0
NE											Xx	4	40	33	183	13	5	0
PR												xx	8	2	27	1	0	2
SP													xx	6	79	6	6	0

SW														xx	74	3	6	1
En															xx	195	154	30
Sc																xx	19	8
Wales																	xx	1
N-Ir																		xx
USA	54	96	74	95	243	419	25	28	217	0	313	20	133	138	816	76	36	11
Can	13	16	10	12	77	63	2	2	23	0	57	2	17	21	169	31	15	4
Russia	5	2	2	9	8	14	1	0	2	0	5	1	2	6	24	2	0	1
Ausrral	7	10	3	5	18	31	2	5	19	0	33	2	12	8	213	19	24	4
Japan	4	6	1	5	13	15	1	1	7	0	11	1	8	15	37	5	1	0
Israel	0	7	5	5	17	23	0	1	7	0	13	0	5	2	26	3	1	0
Norwa	7	7	29	24	8	19	0	0	5	0	14	0	4	46	38	4	3	0
Croatia	3	1	0	1	0	1	0	1	1	0	2	0	0	2	3	1	1	0

The calculation of statistical significance of collaboration relatedness of two countries was made according to the formula :

$$S = (X_{ij} - m) / \sqrt{m}$$

$X_{ij}$  – real number of joint publications of countries  $i$  and  $j$

$m$  - mathematical expectation of number of joint publications of countries  $i$  and  $j$

$$m = (F_i \cdot F_j) / N,$$

$F_i$  – number of joint publications of country  $i$ ;

$F_j$  – number of joint publications of country  $j$  ;

$N$  - total number of joint publications.

Collaboration relatedness between pairs of countries is given below in table 7 for 10 new EU member-states and in table 8 for 15 ‘old’ EU member-states (with  $S > 0.2$ ).

Table 7 The values of collaboration relatedness  $S$  of pairs of countries

	Country $i$	Country $j$	Collaboration relatedness $S$
1	CZECH-REP	France	0.8
		Germany	0.9
		USA	0.9
2	POLAND	France	0.5
		Germany	1.2
		Netherlands	1.3
		Hungary	3.5
		USA	1.0

		Israel	0.7
		Japan	0.7
		Russia	0.5
3	HUNGARY	Finland	1.7
		Netherlands	1.0
		Scotland	1.8
		Poland	3.5
		USA	1.1
		Canada	1.8
		Israel	1.3
4	SLOVAKIA	Germany	1.3
		England	2.0
		Croatia	3.4
5	SLOVENIA	Italy	2.8
		Spain	3.0
		Sweden	1.6
		Croatia	4.1
6	ESTONIA	Sweden	4.1
		Russia	2.3
7	CYPRUS	Greece	7.4
		Canada	5.5
		Russia	1.2
8	LITHUANIA	England	2.5
		N-Ireland	9.0
9	MALTA	England	2.6
10	LATVIA	England	1.4

Table 8 The values of collaboration relatedness  $S$  of pairs of countries ( $S > 0.2$ )

	<b>Country <math>i</math></b>	<b>Country <math>j</math></b>	<b>Collaboration relatedness <math>S</math></b>
	AUSTRIA	Belgium	5.7
	BELGIUM	France	4.4
		Netherlands	6.9
		Spain	0.5
	DENMARK	Finland	2.3
		Sweden	3.4
		England	1.8
	FINLAND	Sweden	6.4
	FRANCE	Canada	5.6
		USA	1.98
	Germany	Canada	0.9
		Israel	2.3
		USA	3.8
	GREECE	England	1.8
	IRELAND	England	2.2
	ITALY	USA	2.5
	NETHERLANDS	USA	1.2
		Canada	0.2
	PORTUGAL	England	0.3
	SPAIN	USA	0.3
	SWEDEN	Norway	11.1





countries	6202	213	2794	534	415	131	115	208	84	17
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The number of collaboration publication of 15 'old' EU member-states is 10480. The per cent of joint publication inside this group of counties it is very high ( 59%). The corresponding figures of the 15 old EU countries are - from 26.7 (USA) to 0.8 (Russia). As for scientific collaboration of 15 old EU member-states with 10 new member-states we can see that only 2 per cent of all joint publication falls on these countries.

5. The most significant research cooperation among 15 'old' EU countries represents following groups of countries: Norway – Sweden- Finland, Austria – Belgium – Netherlands, Scotland – England – Wales, England – Australia.

On the whole the scientific cooperation shows slight collaboration of 10 countries both with 15 EU countries and their mutual collaboration in social science. There is no doubt that entrance into EU will boost research cooperation of new member-states with the core of EU. The EU scientific and education programs are sufficient proofs for that optimism.

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