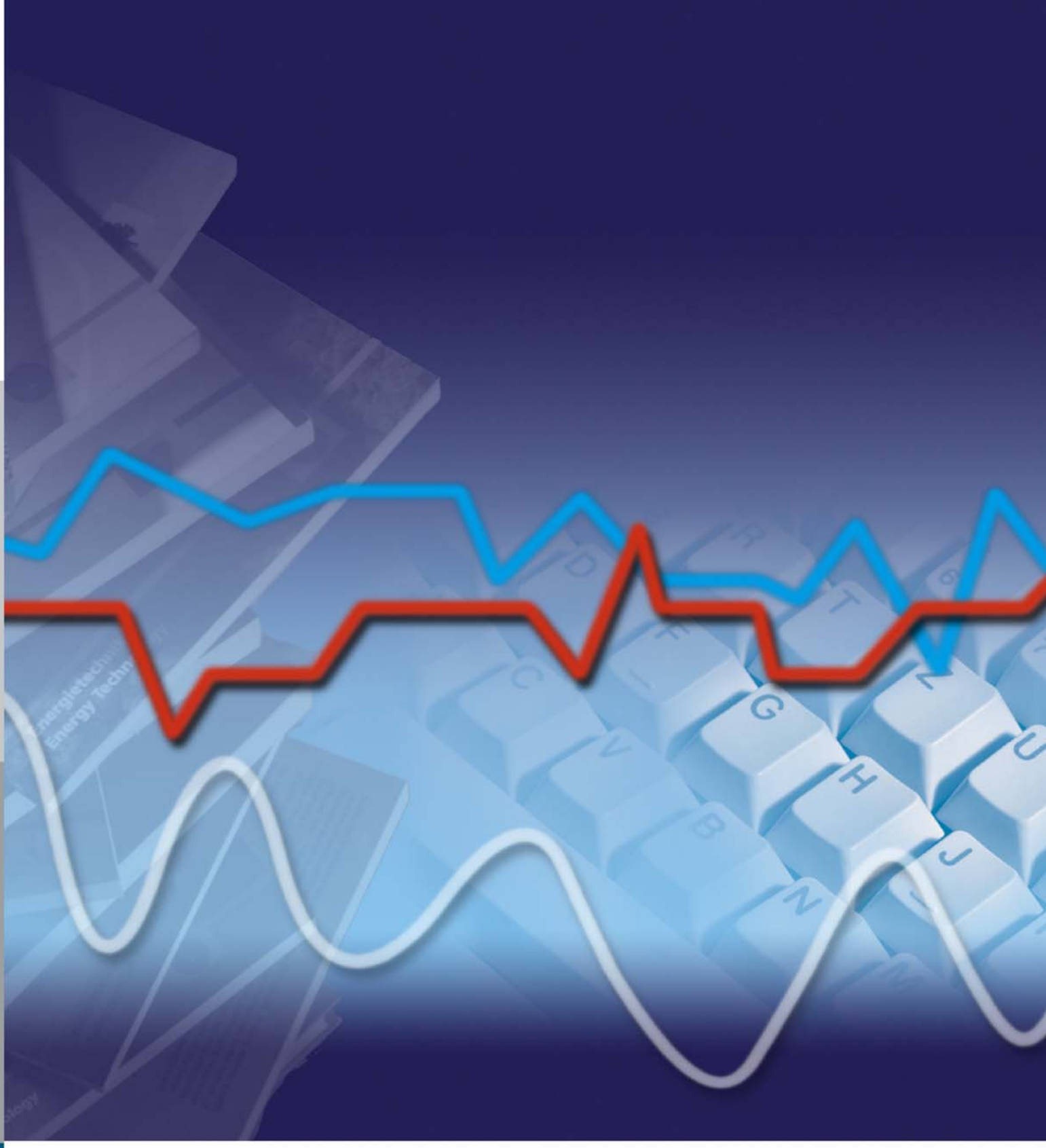

Bibliometric Analysis
Asia-Pacific Research Area
commissioned by the International Bureau of BMBF at DLR

JÜLICH
FORSCHUNGSZENTRUM

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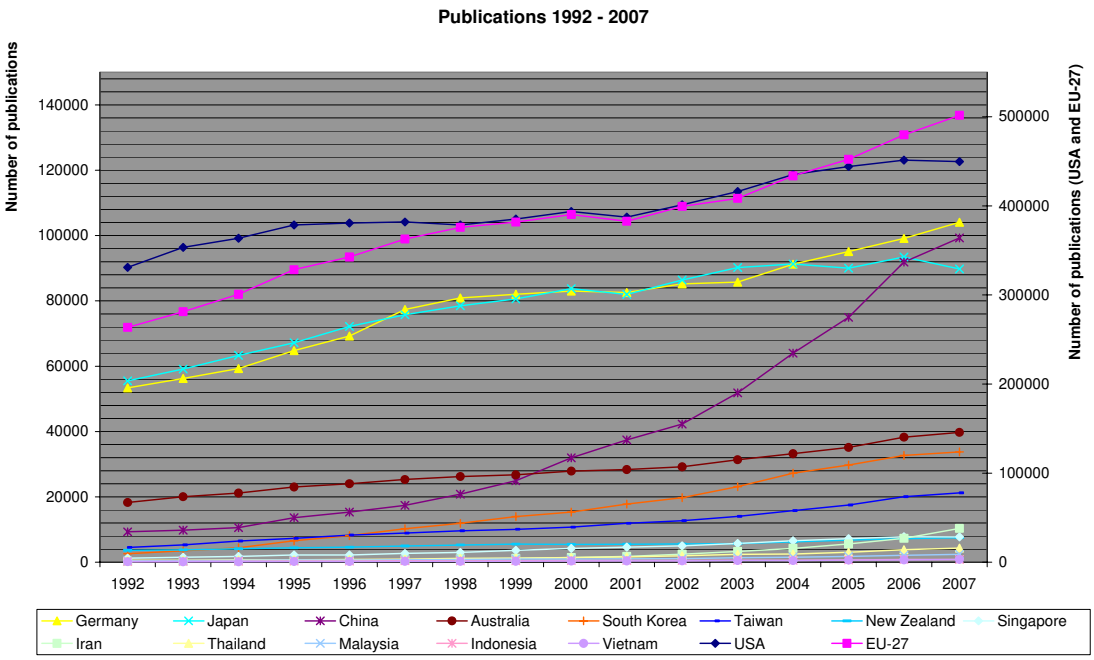
Data Sources

- Thomson Scientific (ISI) databases Science Citation Index Expanded (SCI), Social Sciences Citation Index (SSCI) and Arts & Humanities Citation Index (A&HCI), accessed via the Web of Science in July 2008
- Science Citation Index Expanded, accessed via STN in August 2008
- "Discipline-specific profiles" update: Thomson Scientific (ISI) databases Science Citation Index Expanded (SCI), Social Sciences Citation Index (SSCI) and Arts & Humanities Citation Index (A&HCI), accessed via the Web of Science in August 2009
- "Network analysis" update: Thomson Scientific (ISI) databases Science Citation Index Expanded (SCI), Social Sciences Citation Index (SSCI) and Arts & Humanities Citation Index (A&HCI), accessed via the Web of Science in April 2009

Management Summary

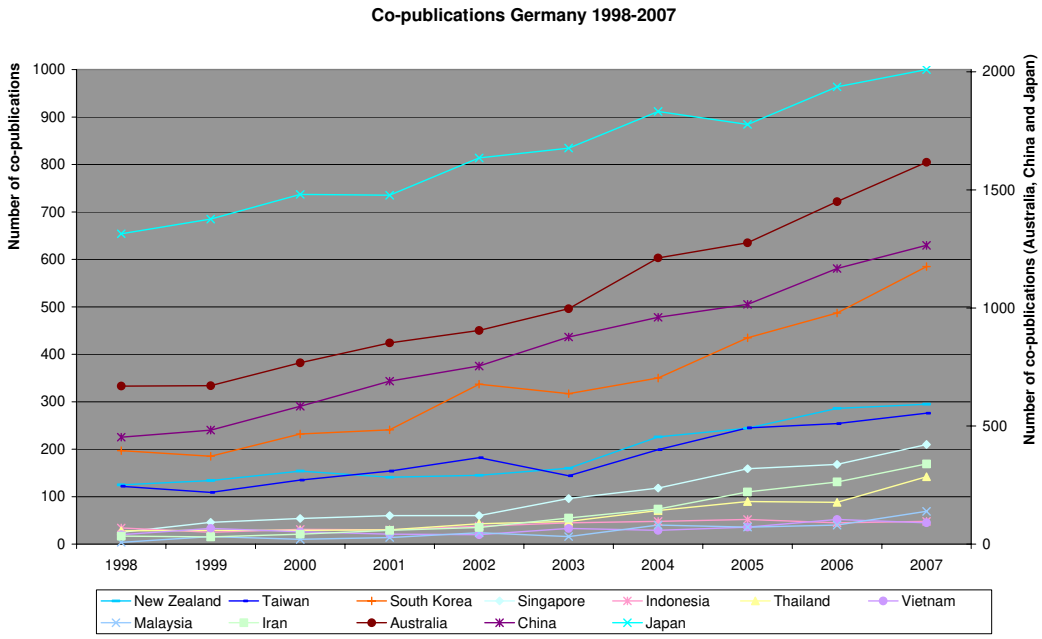
Bibliometric analyses provide information on publication performance (quantitative), the perception and impact of publications in the specialist community (qualitative), and international scientific cooperations (co-publication analysis).

Of all of the various types of scientific publications (e.g. books, conference papers and essays), bibliometric analyses focus predominantly on publications in journals. A database, known to scientists as the Web of Science, evaluates approximately 9,300 international scientific journals on a regular basis. The Web of Science consists of the Science Citation Index (SCI), the Social Sciences Citation Index (SSCI) and the Arts & Humanities Citation Index (A&HCI). The indexed journals are referred to as the “core journals” and they publish the majority of scientific research results.



This study focuses on the following countries from the Asia-Pacific research area: Australia, China, Indonesia, Iran, Japan, Malaysia, New Zealand, Singapore, South Korea, Taiwan, Thailand and Vietnam. The first aspect we look at is an **output analysis** of these and other selected countries. The development of the publication frequency in the Web of Science database will be investigated for the period 1992 to 2007. The figure above shows the number of publications by each country studied during the period under investigation. The almost exponential increase in publications by China can be clearly seen. This aspect will be taken up and discussed again in all of the following chapters of this analysis. Furthermore, this development of publication activity reveals that Japan is on a similar course to Germany in terms of the number of published scientific articles, and also that Japan is well ahead of the other countries studied. The increase in publications in the period under review from 1992 to 2007 in Japan, however, is much smaller than in China. Iran, in contrast, experienced a forty-fold increase in its output. However, it should be noted that Iran has a very low total number of publications.

Another focal point of this bibliometric analysis is the **co-publication activity** for the individual countries with Germany, the USA and with each other. The figure opposite very clearly shows that Japan is the country with the most co-publications with Germany, followed by Australia and China. Despite the rapid increase in the total number of its publications, China remains the country with the third largest number of co-publications with Germany (8,242 articles) throughout the period under review. With 10,417 articles, Australia is in second place, while Japan is in first place with 16,514 publications.



These co-publications represent 1.9 % of the total number of publications for both Japan and Germany. From Germany's perspective, Japan is followed by Australia and China in second and third place with 1.2 % and 0.9 %, respectively. Co-publications with Germany represent 6.6 % and 6.4 %, respectively, of Indonesia's and Vietnam's total output, making Germany the most important cooperation partner among the 12 nations studied for Indonesia and Vietnam.

	Number of co-publications with Germany	Weighting from the country's perspective	Weighting from Germany's perspective
Japan	16514	1.9%	1.9%
Australia	10417	3.3%	1.2%
China	8248	1.5%	0.9%
South Korea	3366	1.5%	0.4%
New Zealand	1910	3.1%	0.2%
Taiwan	1820	1.3%	0.2%
Singapore	996	1.8%	0.1%
Iran	656	1.7%	0.1%
Thailand	598	2.5%	0.1%
Indonesia	396	6.6%	0.04%
Vietnam	315	6.4%	0.04%
Malaysia	269	1.9%	0.03%

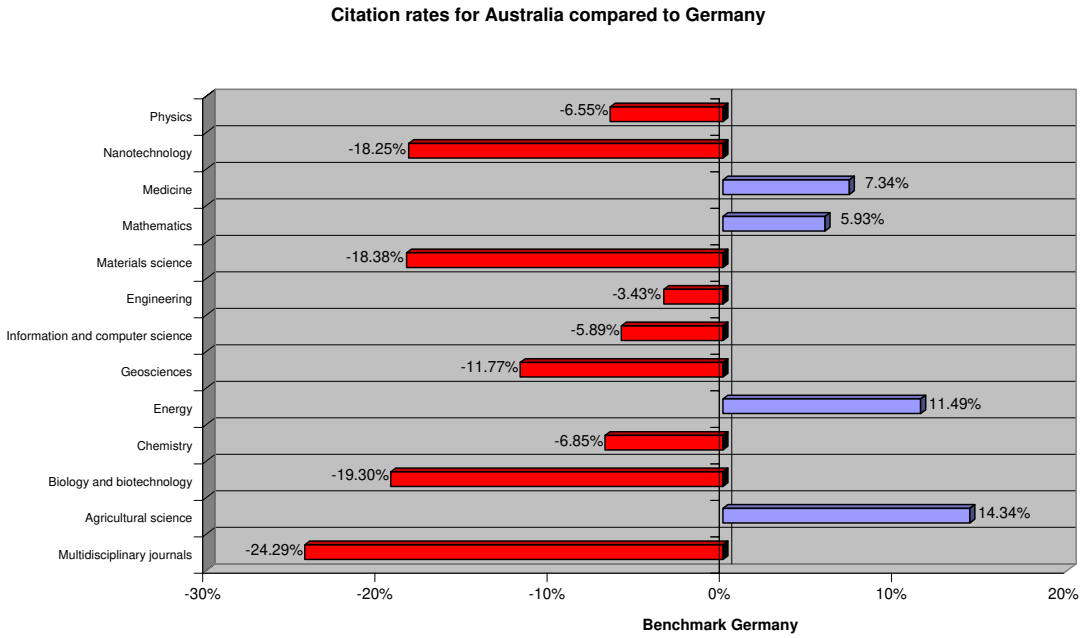
At the level of research disciplines, a ranking provides information on the co-publication partners for each country studied. Such ranking lists allow us to demonstrate changes in publication behaviour and scientific cooperations for two periods of five years and the total period under review as a whole. For example, China published the third-highest number of joint publications in the field of physics with Germany in the period 1998 to 2007 (4,197 publications). Ahead of China are Japan (4,562 publications) and the USA with 9,932 articles. To summarise, Germany holds one of the top ranks very often and is included in almost every top-ten list. In around 15 % of all cases, Germany is among the top three countries analysed. This allows us to conclude that in addition to countries such as the USA, Japan, and the United Kingdom, Germany is extremely important for the countries studied here from the Asia-

Pacific research area. Germany did not experience any significant shifts over the course of the survey conducted here in either of the two periods analysed.

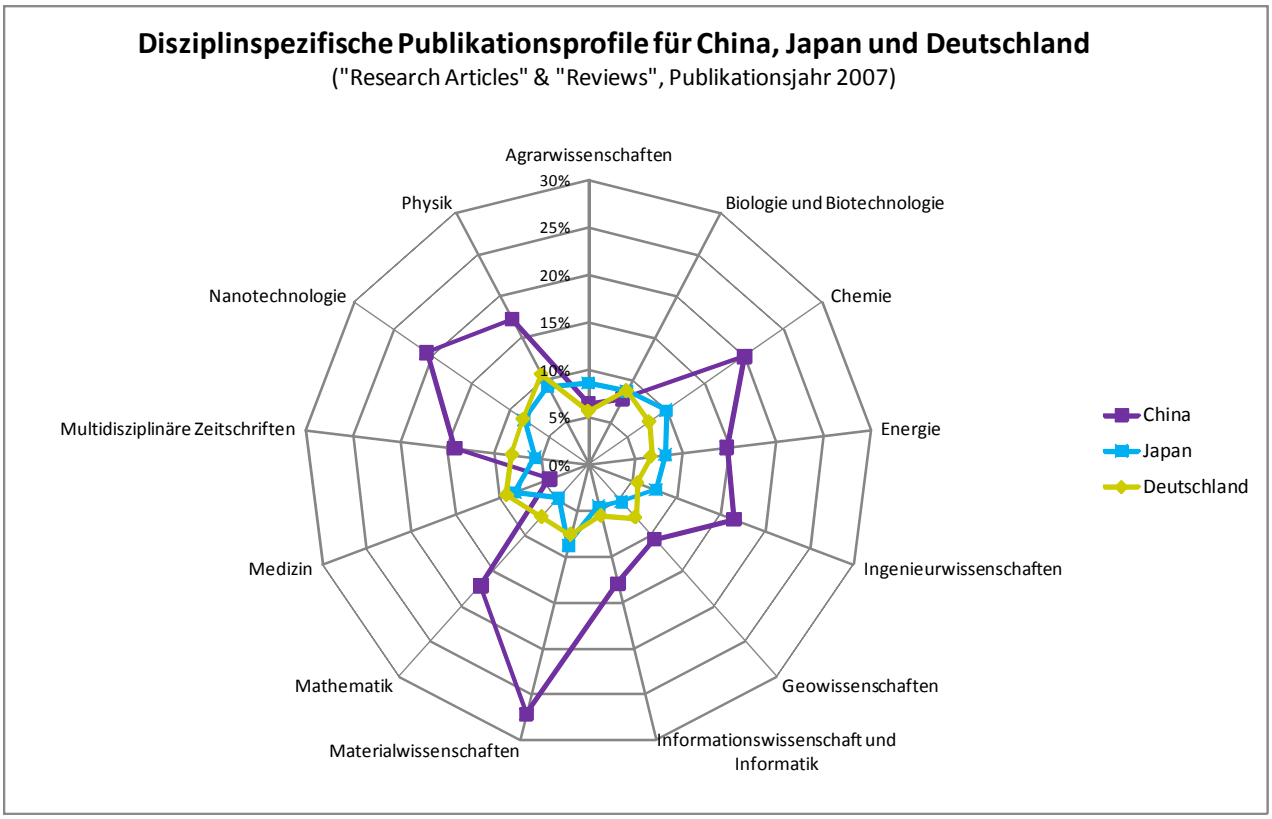
China, Physics		
1998-2007		
#	*Country*	*Co-Publications*
1	USA	9932
2	Japan	4562
3	Germany	4197
4	UK	2744
5	France	2168
6	Russia	1798
7	South Korea	1657
8	Canada	1656
9	Italy	1587
10	Singapore	1541

The next step involves breaking down the output into **scientific disciplines** in order to provide an exact outline of the development of scientific publications at this level. This allowed us to determine that of all of the publications by the 12 countries studied in the field of biology and biotechnology, 30 % were contributed by Japan, while China contributed 30 % in the mathematical and chemistry publications that were evaluated (see Figures 39 and 40 for more on this).

In the third chapter of this study, a **citation analysis** is performed in order to determine the citation rates for all of the countries studied in the scientific disciplines. The perception of each of the countries in the individual disciplines is then compared in a variety of constellations for the entire period under review and over time between the countries. In order to include another benchmark in addition to the comparison of countries, the perception of the countries in the individual disciplines is compared to that of Germany in the same subject. If we take Australia as an example, as shown in the adjacent figure, we can see how high the percentage deviation of the citation rate is in comparison to Germany. For example, the perception for Australia as a country in the discipline of "agricultural science" is 14 % higher than for Germany. In mathematics, Australia's perception is 6 % lower than Germany's. The perception of Australia is as good as or better than that of Germany in four disciplines. It therefore counts as one of the countries with the highest citation rates in this study.



Comparisons were not just performed with Germany, but also in relation to an international benchmark, whereby the publication behaviour of the countries studied together with their discipline-specific citation rates were compared to an appropriate global reference.



For this comparison, we determined the share of research articles and reviews published by each country in 2007 in a specific discipline in the databases included in the Web of Science. Distortions were therefore excluded from the comparisons. The graphic above, for example, shows that China was involved in almost 30 % of all publications in the category “materials science” in the Web of Science. The citation rates were also compared with a global reference for each discipline in order to compare the performance of all countries under optimal conditions.

The last chapter of the study looks at the issue of networking between the countries studied in the form of a **network analysis** using bibliometric methods. A network analysis for the Asian countries is compared to a corresponding analysis for a comparable number of countries as a test. The results allow us to conclude that scientific cooperations in South-East Asia have intensified more than the average, which in turn allows us to speak of the development of a research area from a bibliometric perspective.

Data

1. Publication Analysis on a Country Basis

1.1 An International Comparison of Publication Activity

The first chapter of this analysis focuses on the publication activity of all of the countries. We will try to provide an answer to the question of which of the countries analysed from the Asia-Pacific research area[1] has undergone an above-average development over the past number of years. For this purpose, the charts and graphs that follow will take a look at the total publication output of these countries (without breaking the results down according to discipline), as will the development of cooperations in these countries as represented by the number of co-publications.

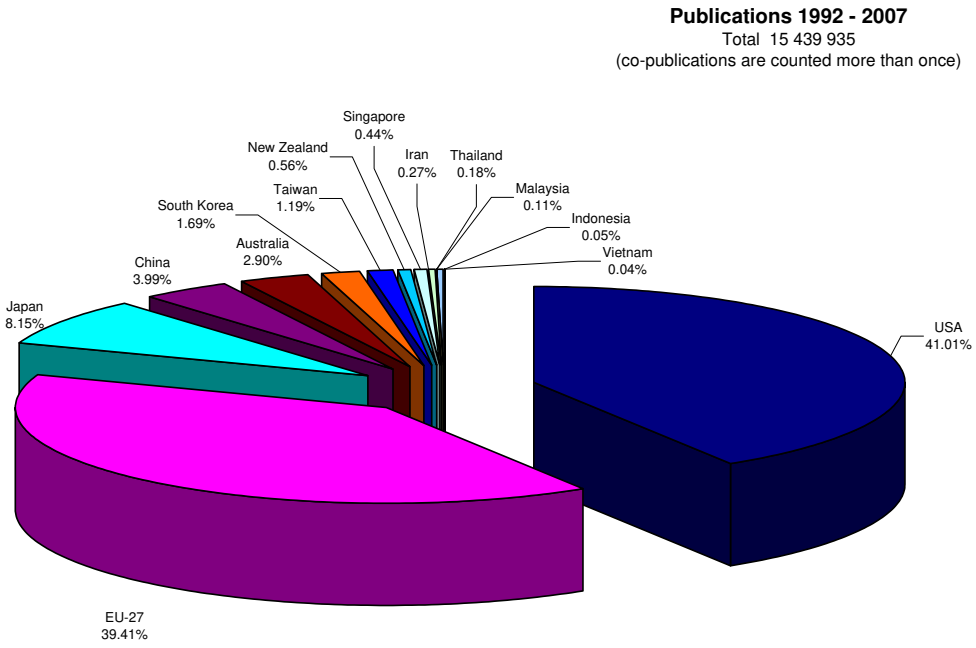


Figure 1: Proportion of publications in selected countries for the period 1992-2007

As an introduction, the publication output of the 12 countries analysed is shown in relation to the output of the 27 EU member states[2] (EU-27) and the USA over the same period. Figure 1 shows a pie chart, where the output of each country (or groups of countries in the case of the EU-27) is shown as a percentage of the total output of all 14 units detailed above. As expected, the majority of publications come from the EU-27 and the USA (39.4 % and 41.0 %, respectively). Of the countries studied, the largest proportion come from Japan (8.2 %), China (4.0 %) and Australia (2.9 %).

While Figure 1 provides an overall impression of the publication activity in the different countries, the figures that follow take a look at the production of articles over time. China is characterised by a high increase in the production of articles. Its growth is almost exponential and leaves all of the other research nations shown trailing behind. In 1992, China started off with around 9,300 publications, which was far less than Australia. In 2007, China boasted almost 100,000 publications, which saw it pass out research nations such as Japan (around 90,000 articles) and almost catch up with Germany (approximately 105,000 publications).

[1] This study focuses on the following countries: Australia, China, Indonesia, Iran, Japan, Malaysia, New Zealand, Singapore, South Korea, Taiwan, Thailand and Vietnam.
[2] EU-27 is defined for the entire period under review as the EU member states as of January 2007.

A high production of articles only describes the basis of visibility not the perception. Previous studies[3] have already shown that China lies well below expectations, which predicted a higher perception due to the high growth in the production of articles. The situation was found to be the same in this study (see Chapter 3). However, the production of articles in China also shows that China is becoming a more important partner in research alliances. Its dynamics should not be underestimated, even if it did experience a slight decrease in 2007.

Figure 2 shows that the majority of countries analysed produce a level of publications that currently ranges between a few hundred to around 10,000 per annum. Some of these countries have high citation rates when taken as percentages, but in terms of absolute numbers, they remain on a relatively low level. Five countries in this group distinguish themselves from the others in that they partially exhibit significantly higher outputs. These include: Taiwan, currently with approximately 20,000 publications per annum, South Korea (approx. 33,000), Australia (approx. 40,000), Japan (approx. 90,000) and China (approx. 100,000). Out of all of the countries studied, China is the only country that has sustained a high relative increase together with a comparably high output over the entire period of this analysis.

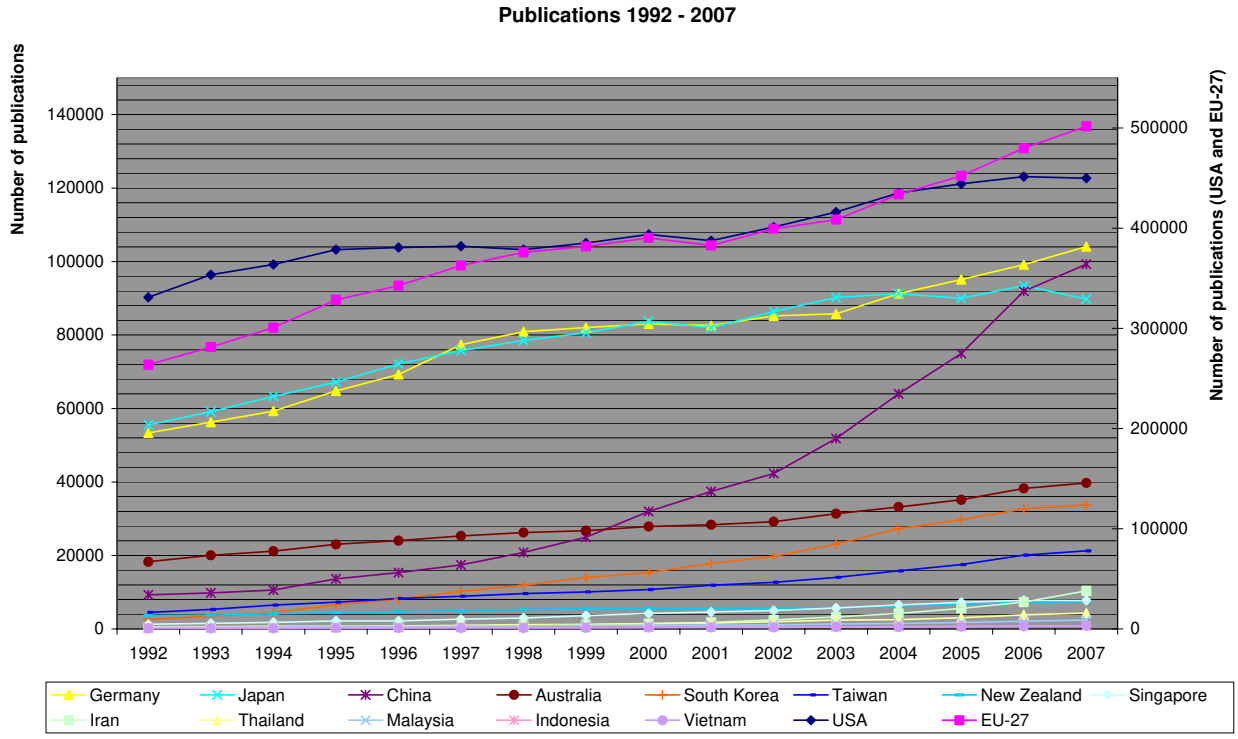


Figure 2: Absolute number of publications over time

In Figure 3, data from 1992 are taken as 100 %. This allows us to measure the relative development of publications in the years that followed in relation to the first year of the analysis. Due to the fact that other countries began with a lower initial value, the growth of almost all of the countries was found to be higher than the growth of Germany. The exceptions to this are the USA and Japan, who generally exhibit a low publication development in terms of percent. The leading country with regard to relative publication growth is Iran: between 1992 (253 publications) and 2007 (10,346 publications), Iran experienced a forty-fold growth.

[3] For example, see Mittermaier et al. 2006/2007: WissdeX – Das bdw-Wissenschaftsranking (Bild der Wissenschaft 03/2006 – 05/2007), http://epaper.konradin-relations.de/wissdex/

High growth also characterises the relative development of the publication output in South Korea (thirteen-fold), and as mentioned above, China (around ten-fold).

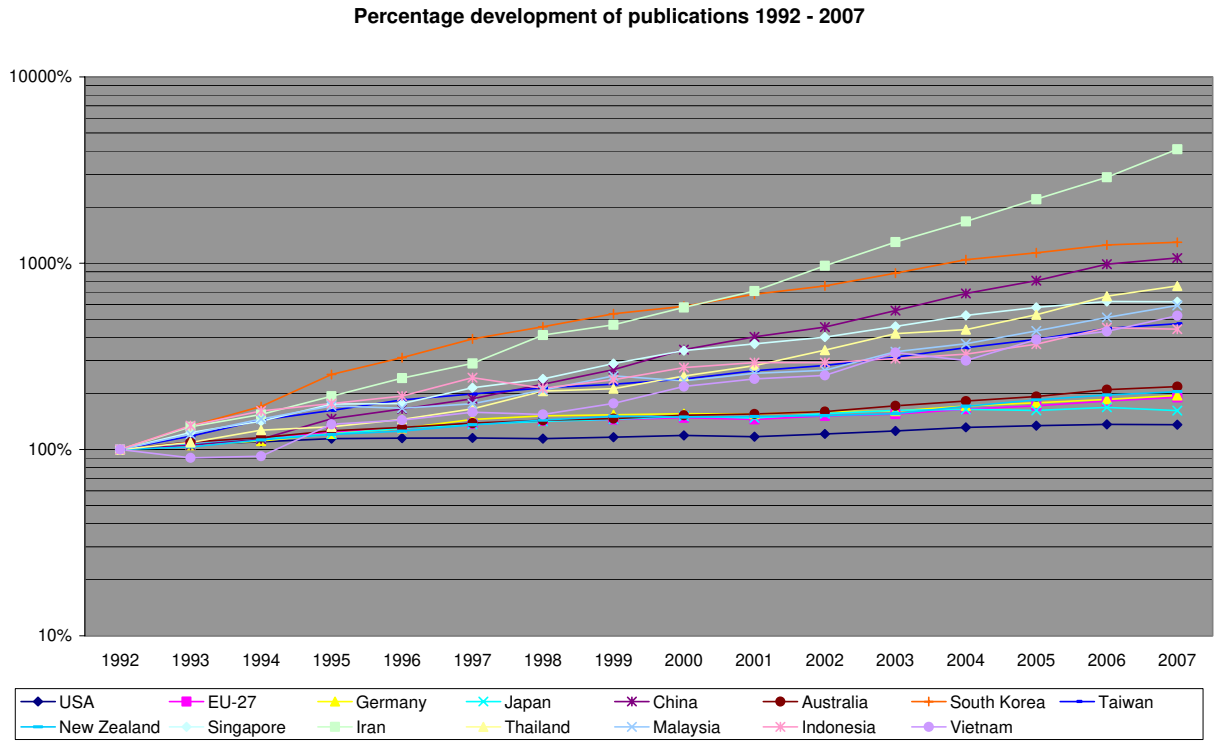


Figure 3: Relative number of publications over time (logarithmic scale)

The table on the next page contains the absolute number of publications for each of the countries in the analysis.

Country	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1992-2007 Total
USA	330980	353451	363715	378599	380672	381900	378514	385240	393702	387418	401149	416123	435187	444115	451429	449767	6331961
EU-27	263716	281338	300717	328415	342591	362742	375829	381830	390277	382773	399391	408434	433758	452236	479751	501636	6085434
Germany	53378	56281	59287	64792	69261	77389	80901	82041	83027	82584	85207	85769	91273	95113	99128	104068	1269499
Japan	55533	59120	63322	67157	72172	75736	78514	80631	83762	82005	86393	90220	91295	90007	93450	89773	1259090
China	9309	9811	10576	13611	15343	17418	20832	24969	31966	37438	42283	51833	63996	74959	91915	99270	615529
Australia	18277	20035	21175	23032	24028	25308	26236	26758	27884	28363	29192	31370	33223	35137	38272	39758	448048
South Korea	2613	3496	4441	6595	8124	10249	11898	13979	15327	17804	19728	23118	27289	29724	32699	33792	260876
Taiwan	4493	5297	6466	7278	8283	8913	9622	10065	10713	11896	12691	14048	15794	17516	20072	21245	184392
New Zealand	3666	3781	4123	4417	4600	4976	5271	5521	5469	5507	5570	5705	6259	6765	7196	7491	86317
Singapore	1251	1541	1774	2194	2203	2686	2991	3616	4243	4614	5020	5721	6556	7237	7790	7756	67193
Iran	253	335	390	488	611	733	1041	1181	1464	1794	2448	3283	4238	5573	7309	10346	41487
Thailand	573	625	728	759	831	948	1179	1215	1420	1614	1957	2399	2520	3031	3811	4319	27929
Malaysia	408	493	595	698	679	718	850	1012	953	1046	1085	1367	1509	1765	2085	2417	17680
Indonesia	187	251	301	330	362	454	399	443	515	548	548	575	608	687	843	827	7878
Vietnam	164	148	151	224	236	260	253	290	357	392	410	543	492	638	706	857	6121
Total	**691423**	**739722**	**778474**	**833797**	**860735**	**893041**	**913429**	**936750**	**968052**	**963212**	**1007865**	**1054739**	**1122724**	**1169390**	**1237328**	**1269254**	**15439935**

Table 1: Absolute number of publications for the countries studied

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Figures 4 – 8 present the previous results on publication activity in different forms. Figures 4 and 5 present this information in terms of time: blocks of years are taken as the basis to show the development. This displays the development of the key countries and makes clear that the growth in publications in Europe and the USA is quite low in comparison.

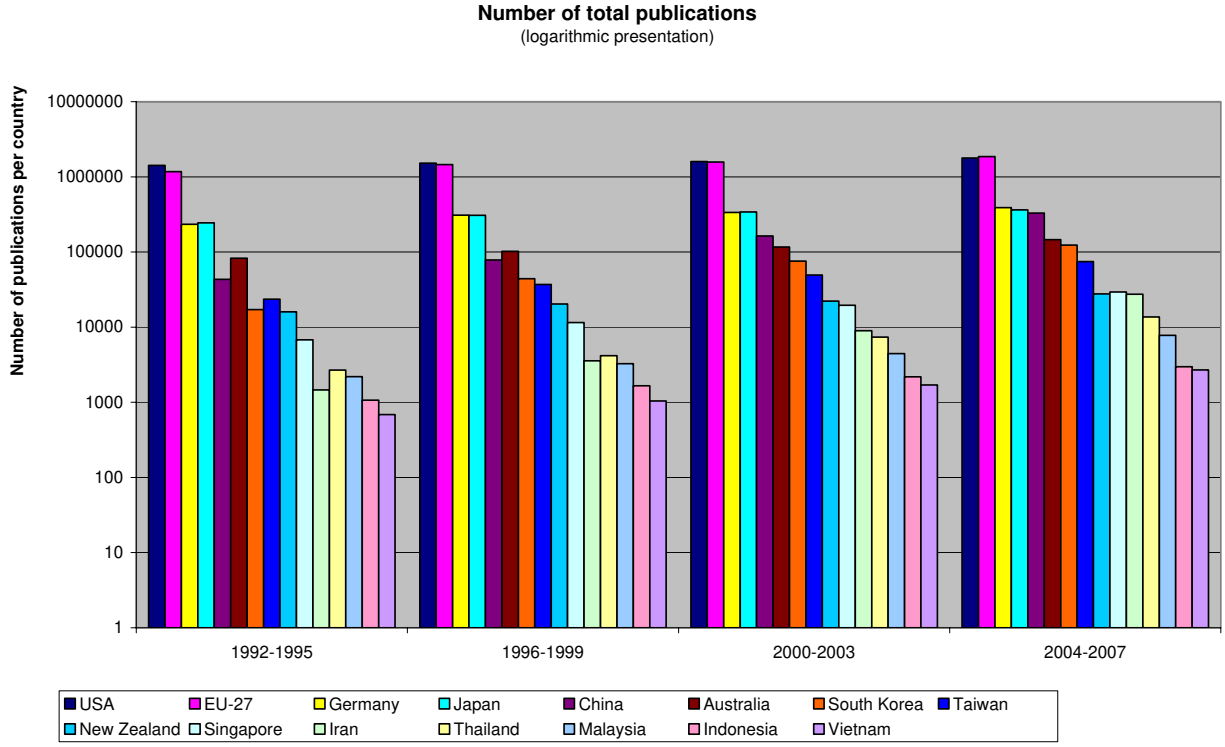

Figure 4: Number of total publications for the countries studied in the form of four-year blocks (logarithmic scale)

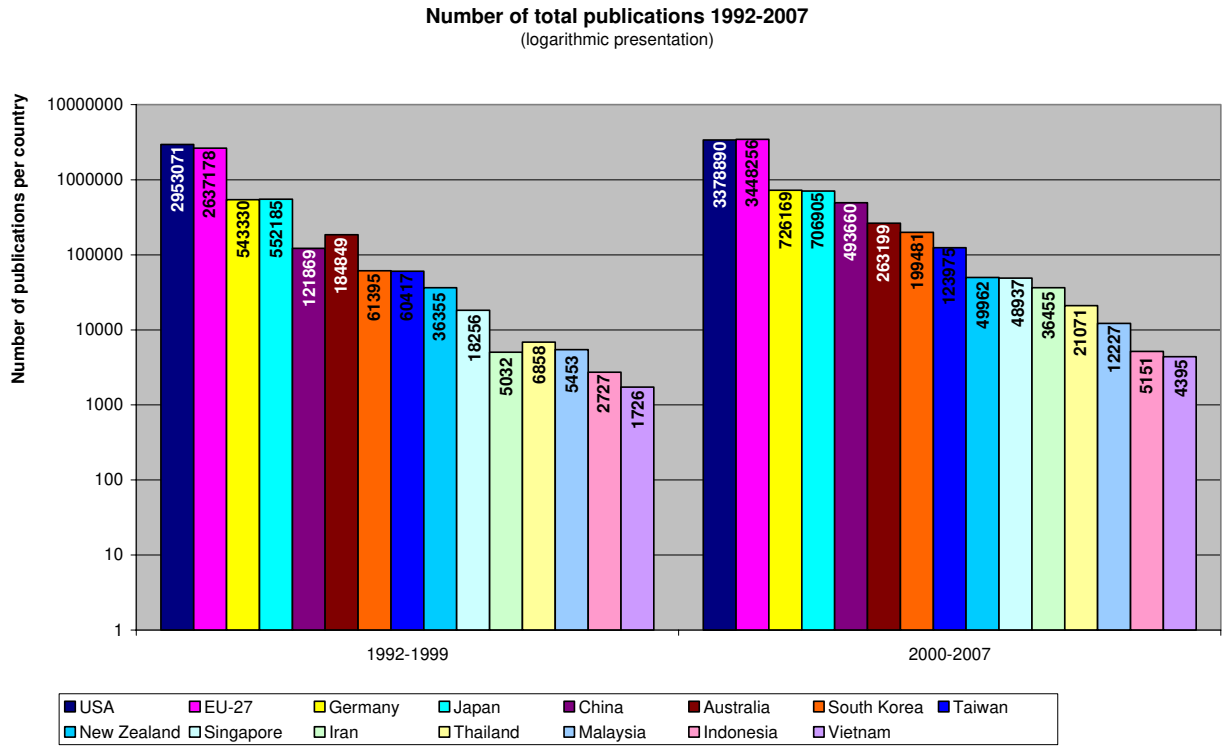

Figure 5: Number of total publications for the countries studied in the form of eight-year blocks (logarithmic scale)

Figures 6 to 8 show graphs of different combinations of the countries, and illustrate the development described from different perspectives. Figure 6 focuses on the smaller research nations, Figure 7 shows the most dynamic countries, and Figure 8 depicts all of the countries in comparison with Germany.

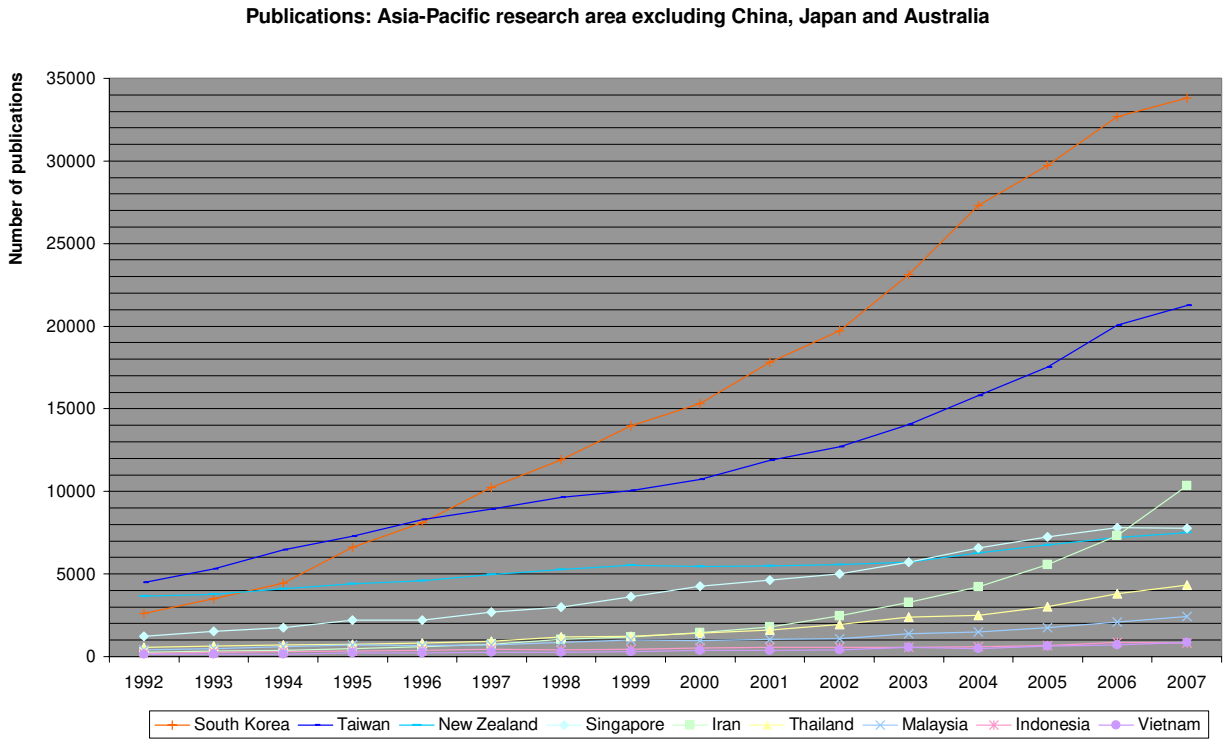

Figure 6: Number of publications over time (excluding China, Japan and Australia)

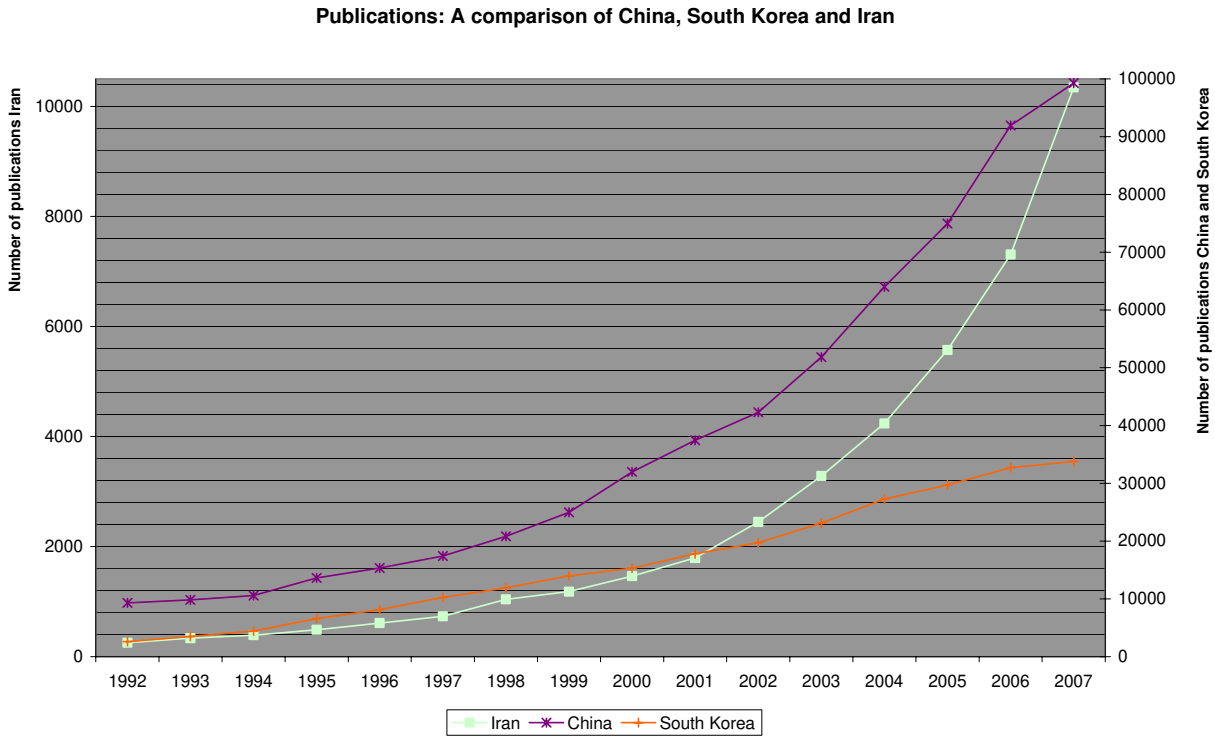

Figure 7: Number of publications over time (Iran, China and South Korea only)

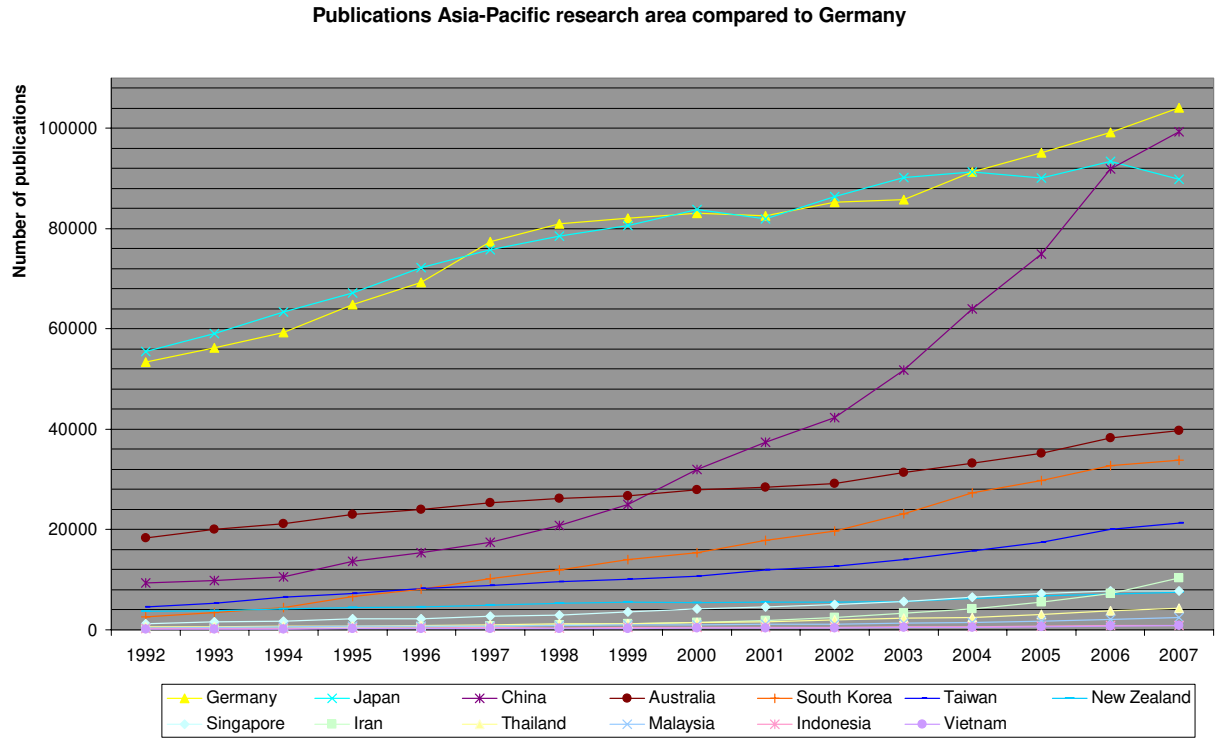

Figure 8: Number of publications over time (excluding EU-27 and USA)

Figures 9 and 10 differentiate between all of the publications listed in the Web of Science (total publications) and what are known as research articles[4]. The distinction is only made for these two figures. All of the other graphs and charts, both before and after Figures 9 and 10, analyse the total number of publications.

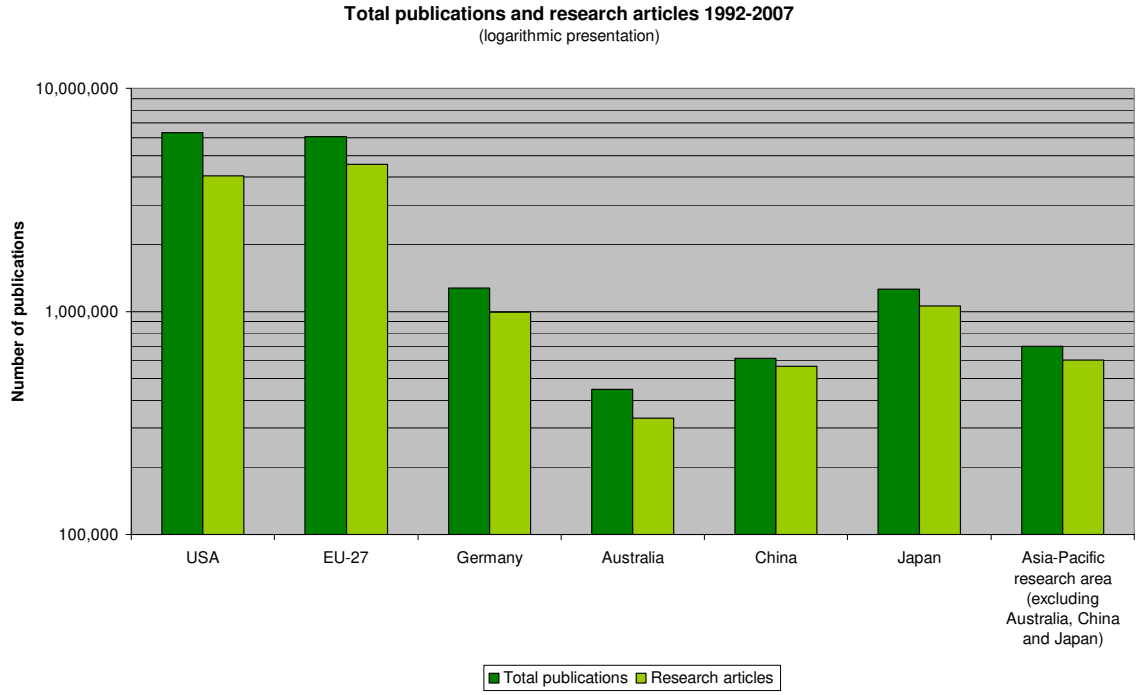

Figure 9: Number of total publications and research articles (logarithmic scale)

[4] Research articles represent the "pure form" of scientific publications: articles that are written for a scientific purpose only, with the aim of disseminating scientific findings. This term does not include editorials, letters, other forms of short communication or review articles.

Figure 9 reveals that a significant proportion of the total publications in some countries consists of documents other than research articles – for example the USA, Australia and the EU-27. In the USA, this proportion of other document types amounts to more than one third. This quota is significantly lower for China and the countries of the Asia-Pacific research area. This difference can be explained by the fact that the editors and publishers of the majority of refereed journals in the Web of Science come from the countries within the EU-27 and, above all, from the USA. This also explains the higher proportion of editorial material.

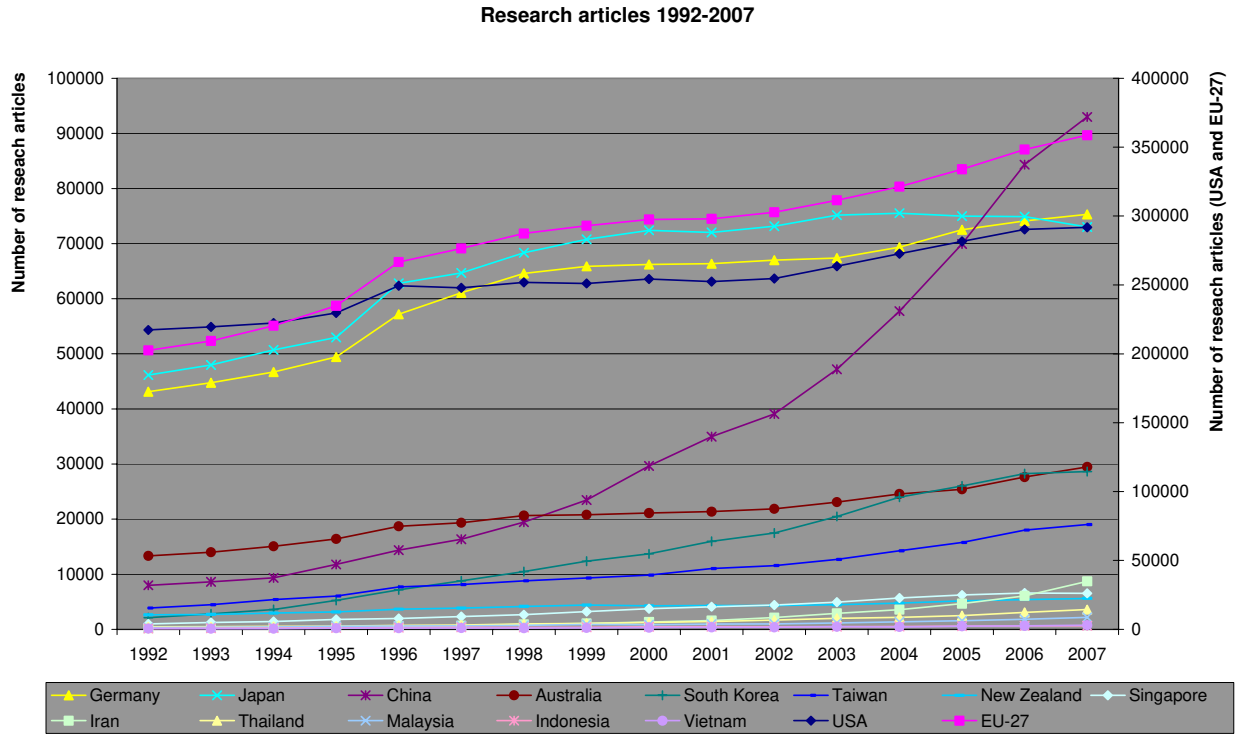

Figure 10: Number of research articles published over time

The development over time of publication activity in the category of “research articles” is extremely similar to the development of the absolute number of publications (Figure 2) in that research articles also account for the largest proportion of total publications. A detailed comparison with Figure 2, however, reveals that the EU-27 had overtaken the USA in terms of the total number of articles 10 years earlier, in other words in 1995, when the assessment basis is research articles. This can be explained by a smaller proportion of research articles in terms of total publications in the USA than in the EU-27. It should also be noted that China overtook Germany in 2006 in terms of the total number of research articles for the very same reason.

Figure 11 illustrates the development of the total number of records in the Science Citation Index (SCI) and how it underlies the evaluations that follow on the relative proportion of publications by a country in terms of the database as a whole. It should be noted that the data shown in Figures 11 – 13 only refer to SCI, the science edition of the Web of Science, in contrast to the other graphs and charts in Chapter 1 of this study.

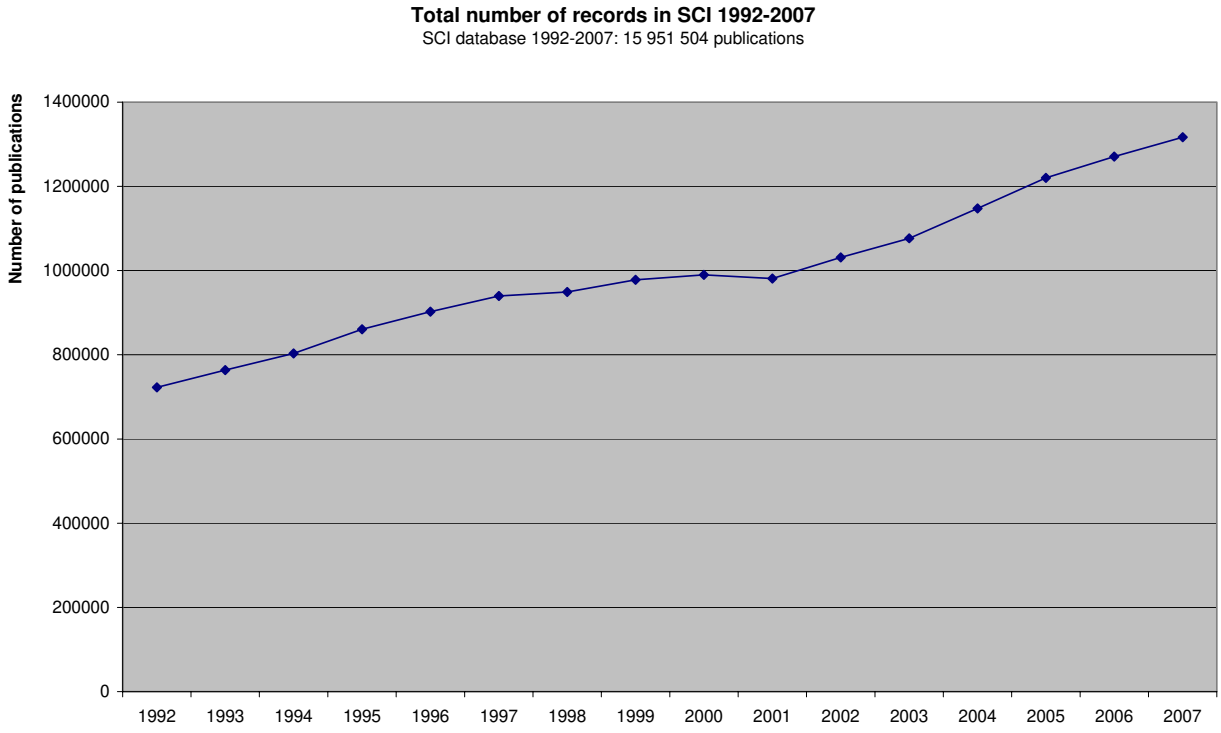

Figure 11: Total number of records in the Science Citation Index (STM sector[5]) over time[6]

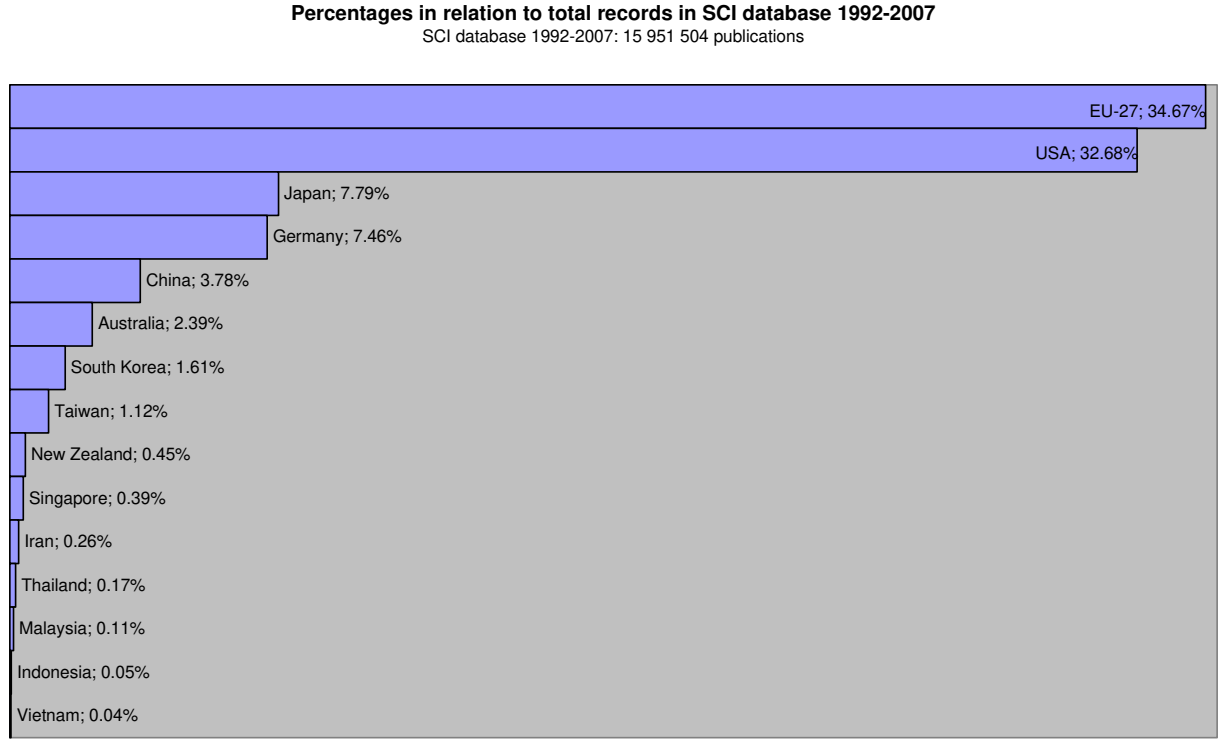

Figure 12: Percentages of publications by individual countries in the SCI database

[5] The term “STM sector” refers to publications in the scientific and technical disciplines as well as those in medicine.

[6] In contrast to the other evaluations, these data were not determined using the Web of Science accessed via SCI but rather using database access provided by STN International. The database and its contents can be considered identical; access was simply gained using a different technical route.

Figure 12 shows that within the period under review 1992 – 2007 the proportion of publications by the EU-27 (34.5 %) and the USA (33.0 %) in the Science Citation Index are of a comparable level[7]. The same is true of Japan (7.8 %) and Germany (7.5 %). China is one of the five countries in the world with the highest proportion of publications in the Science Citation Index with approx. 3.8 % publications. However, compared to the EU-27 or the USA, this represents only one tenth.

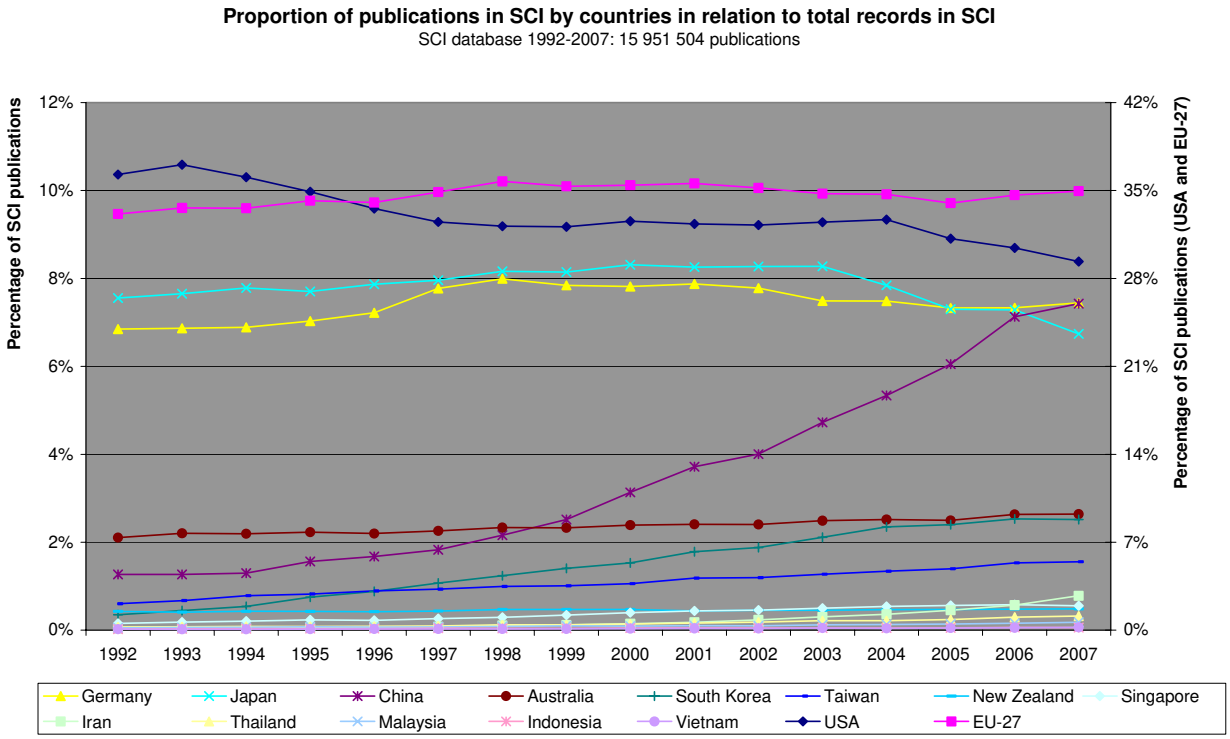

Figure 13: Proportion of countries in relation to total records in SCI

Figure 13 illustrates the proportion of countries in relation to the total records in SCI over time. It is clear that the proportion from the USA is decreasing. In 1992, the USA contributed to more than 35 % of all of the documents listed in SCI, whereas in 2007, this figure had fallen to barely 30 %. The EU-27 proportion remains very stable over the entire period. Remarkable gains were recorded for China: the proportion rose from around 1.5 % in 1992 to around 7.5 % in 2007. The other key countries in this study underwent almost no change in their total share in SCI with the exception of South Korea and Taiwan with small increases. Japan experienced a loss of 1.5 % in its share of publications in SCI.

[7] The values shown in Figure 12 include co-authorship of scientific publications for each country involved in a publication. This means that the summation of all of the values for each country represented in SCI will always be more than 100 %.

1.2 Co-Publications on a Country Basis

Figures 14 to 18 provide information on scientific co-publications between Germany or the USA and the other countries studied. A co-publication is defined as a scientific publication which includes address information (affiliation) for both Germany (or the USA) and the corresponding country (or countries). The corresponding publication is then counted once for each of the countries involved in the analyses that follow.

If we take the absolute values into consideration, most of the co-publications from Germany's perspective are written together with the USA. In 2007, they totalled more than 13,000. The relative increase in relation to the reference year of 1998 is fairly low at 66 %. In contrast to this, co-publications between Germany and China or South Korea tripled (see Figure 15(a)). Some of the other countries achieved significantly higher growth rates, but in all of these cases, the reference data from 1998 were relatively small. For example, co-publications between Germany and Malaysia increased eighteen-fold, but they began with a mere four joint publications in 1998 (Figure 15(b)).

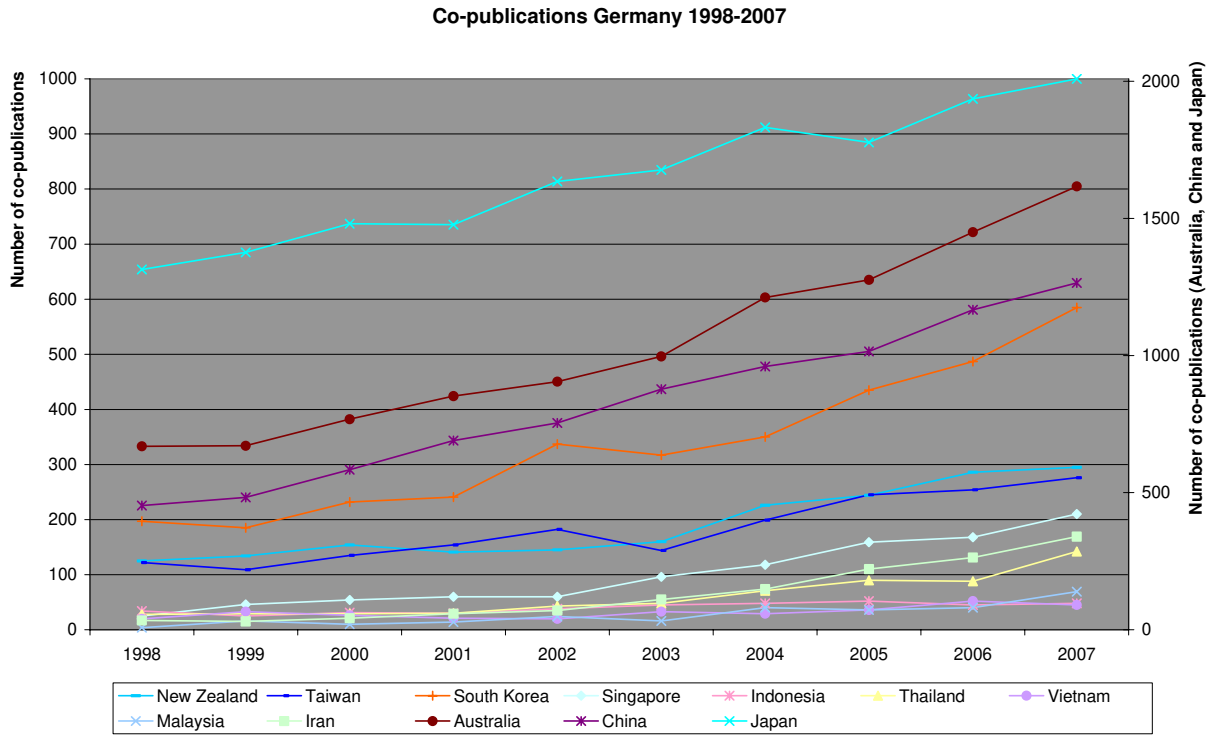

Figure 14: Development of co-publications from Germany's perspective (excluding USA)

Figures 16 and 17 present the same aspect from the USA's perspective. We can see that over time, China pushes back other important co-publication partners, such as Japan, Australia and South Korea. This is the only significant change revealed by Figure 16. This development is closely related to the almost exponential publication development in China in general.

From Figure 17, we can see that the number of co-publications in the period 1998 to 2007 has increased fivefold. It real terms, this represents an increase on a high level from 1,754 to 8,971 publications. The often high growth rates for co-publications with Vietnam or Iran are once again based on relatively low reference data in 1998.

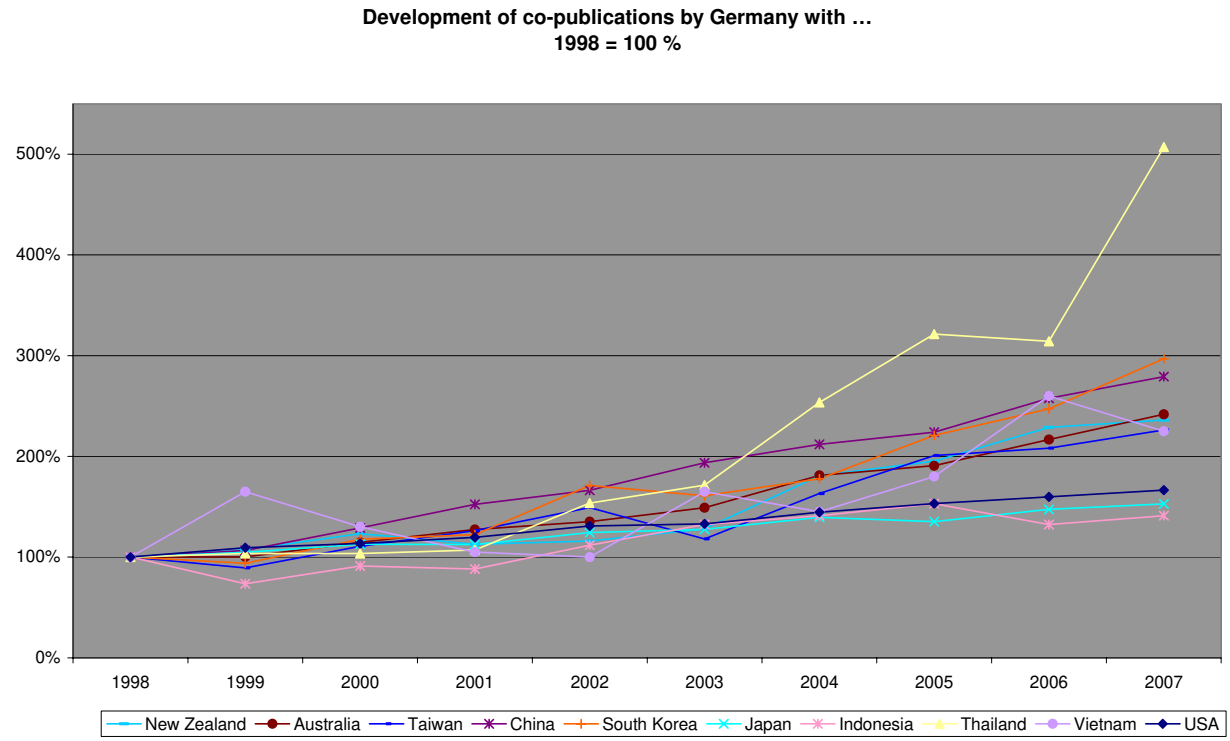

Figure 15(a): Relative development of co-publications from Germany's perspective with respect to 1998 (all of the key countries except Singapore, Malaysia and Iran)

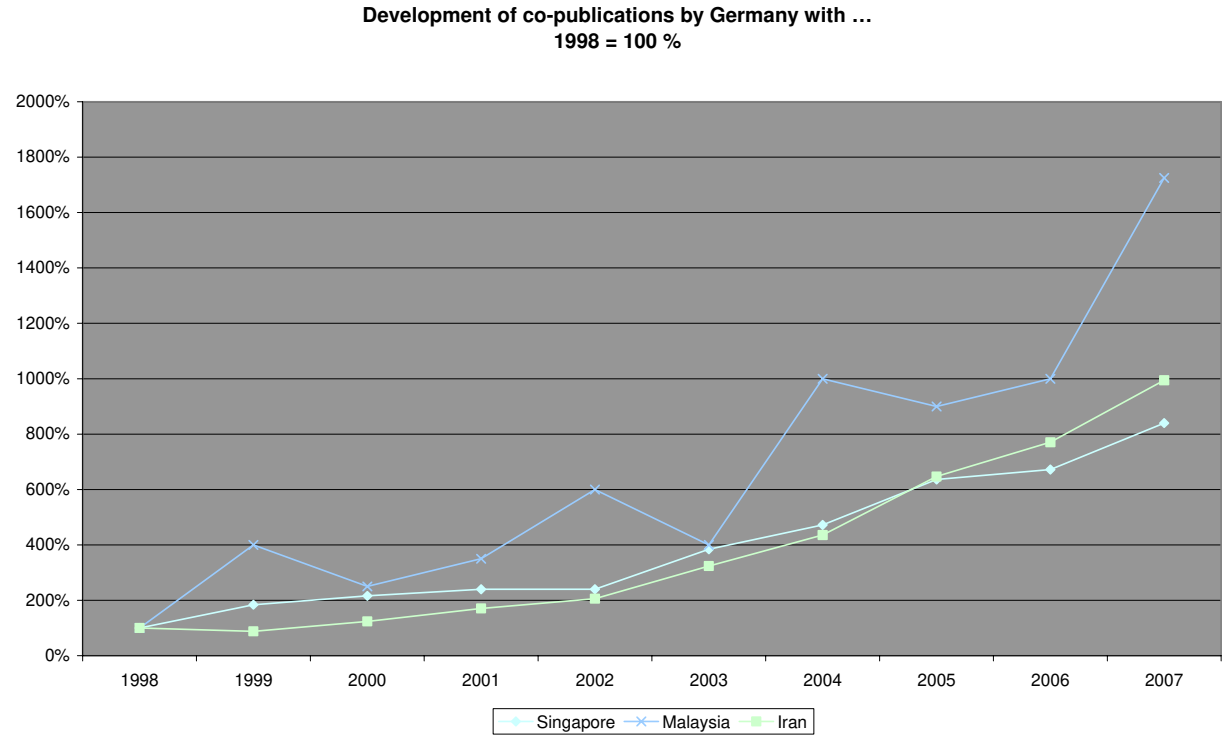

Figure 15(b): Relative development of co-publications from Germany's perspective with respect to 1998 (Singapore, Malaysia and Iran)

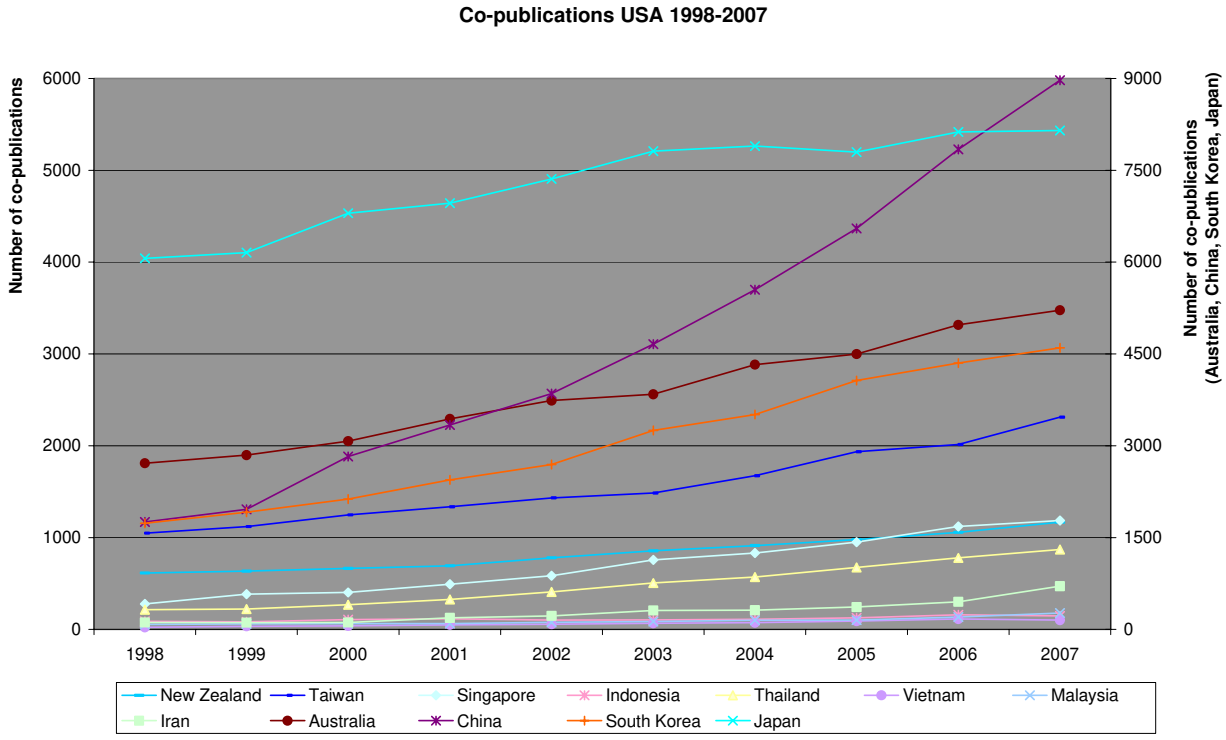

Figure 16: Development of co-publications with the key countries from the USA's perspective

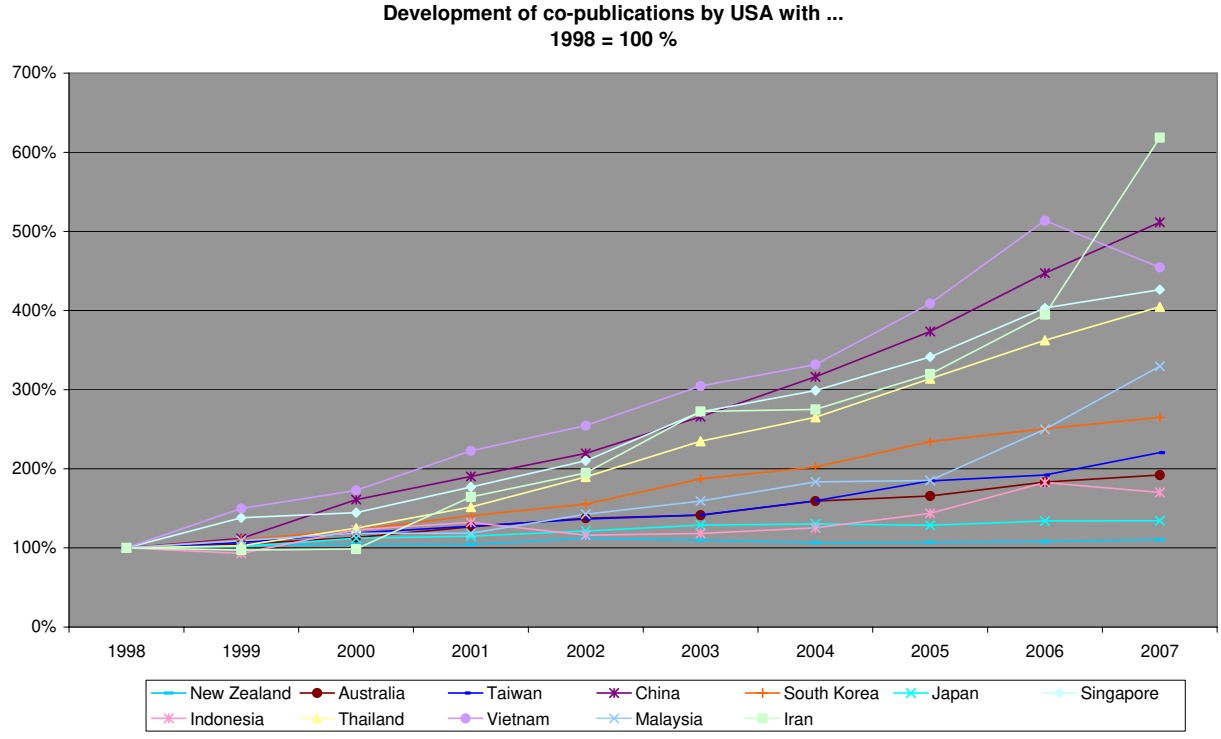

Figure 17: Relative development of co-publications with the key countries from the USA's perspective with respect to 1998

Co-publications by Germany with…

	New Zealand	Australia	Taiwan	China	South Korea	Japan	Singapore	Indonesia	Thailand	Vietnam	Malaysia	Iran	USA
1998	125	669	122	453	197	1314	25	34	28	20	4	17	7991
1999	134	671	109	483	185	1376	46	25	29	33	16	15	8729
2000	154	768	135	584	232	1481	54	31	29	26	10	21	9076
2001	141	852	154	690	241	1477	60	30	30	21	14	29	9553
2002	145	905	182	754	337	1635	60	38	43	20	24	35	10461
2003	160	997	144	877	317	1677	96	45	48	33	16	55	10628
2004	226	1212	199	960	350	1832	118	48	71	29	40	74	11556
2005	244	1276	245	1015	435	1777	159	52	90	36	36	110	12241
2006	286	1450	254	1167	487	1936	168	45	88	52	40	131	12769
2007	295	1617	276	1265	585	2009	210	48	142	45	69	169	13302
Total	1910	10417	1820	8248	3366	16514	996	396	598	315	269	656	106306

Table 2: Number of co-publications by Germany with the target countries and the USA

Co-publications by the USA with…

	New Zealand	Australia	Taiwan	China	South Korea	Japan	Singapore	Indonesia	Thailand	Vietnam	Malaysia	Iran
1998	614	2715	1048	1754	1735	6062	278	87	215	22	54	76
1999	634	2847	1119	1963	1913	6155	384	81	221	33	59	74
2000	664	3077	1247	2826	2130	6800	402	107	269	38	64	75
2001	693	3438	1335	3339	2443	6963	492	115	326	49	64	125
2002	780	3738	1432	3852	2693	7359	584	101	408	56	77	148
2003	856	3840	1485	4660	3250	7813	756	103	505	67	86	207
2004	913	4325	1673	5550	3511	7896	831	109	570	73	99	209
2005	977	4498	1935	6551	4066	7799	949	125	675	90	100	243
2006	1057	4975	2013	7842	4350	8127	1121	159	779	113	135	300
2007	1167	5215	2311	8971	4599	8151	1185	148	870	100	178	470
Total	8355	38668	15598	47308	30690	73125	6982	1135	4838	641	916	1927

Table 3: Number of co-publications by the USA with the target countries

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1.3 Co-Publications on a Country Basis between the Countries Studied

Figures 18 to 34 deal with the co-publication output between the countries studied. Similar to the total publication output, the tendency towards international cooperation also experiences a general increase. Figure 18 illustrates the number of co-publications between the countries studied for the entire period 1998 – 2007. Countries with a high volume of publications in absolute terms also tend to have a high absolute number of co-publications.

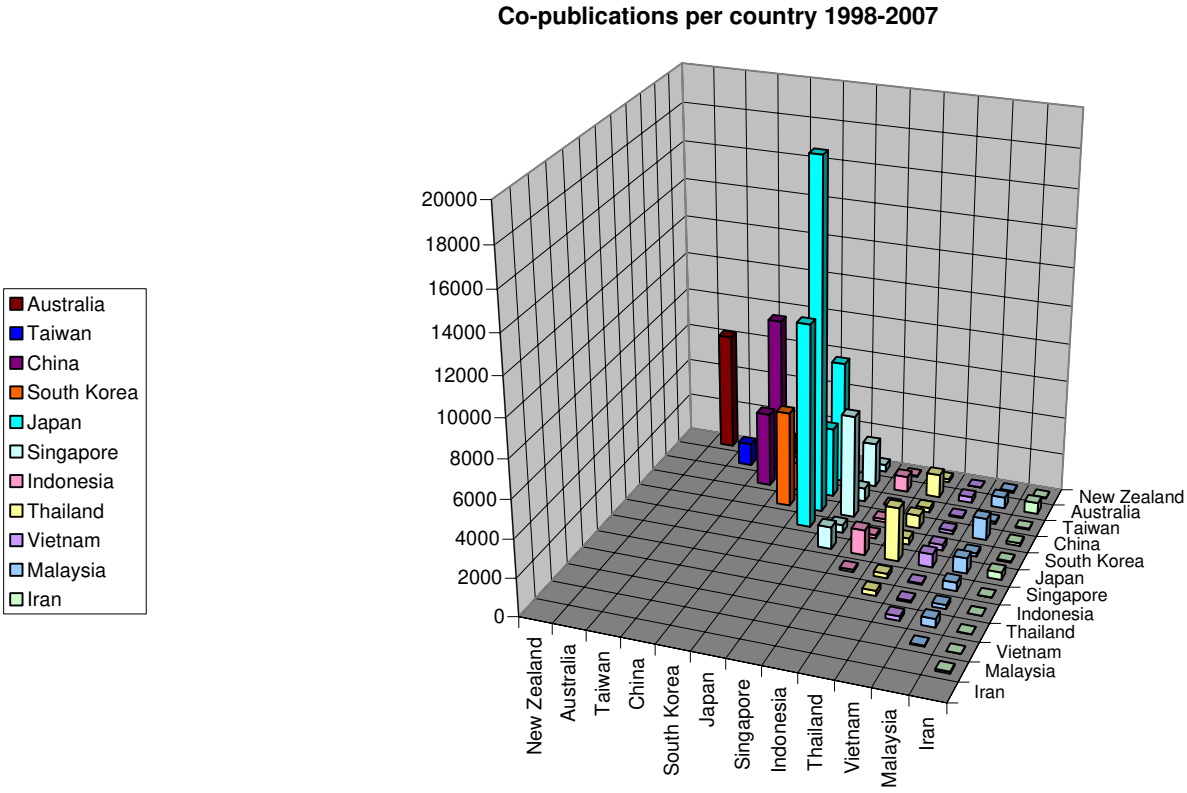

Figure 18: Number of co-publications per country for the period 1998-2007

In Figures 19 and 20, the data shown in Figure 18 for the entire period under review are split into two equally long periods of five years each in order to make the development over time clearer. For example, this allows us to determine an above-average increase in the number of co-publications between Singapore and China and between Australia and Japan.

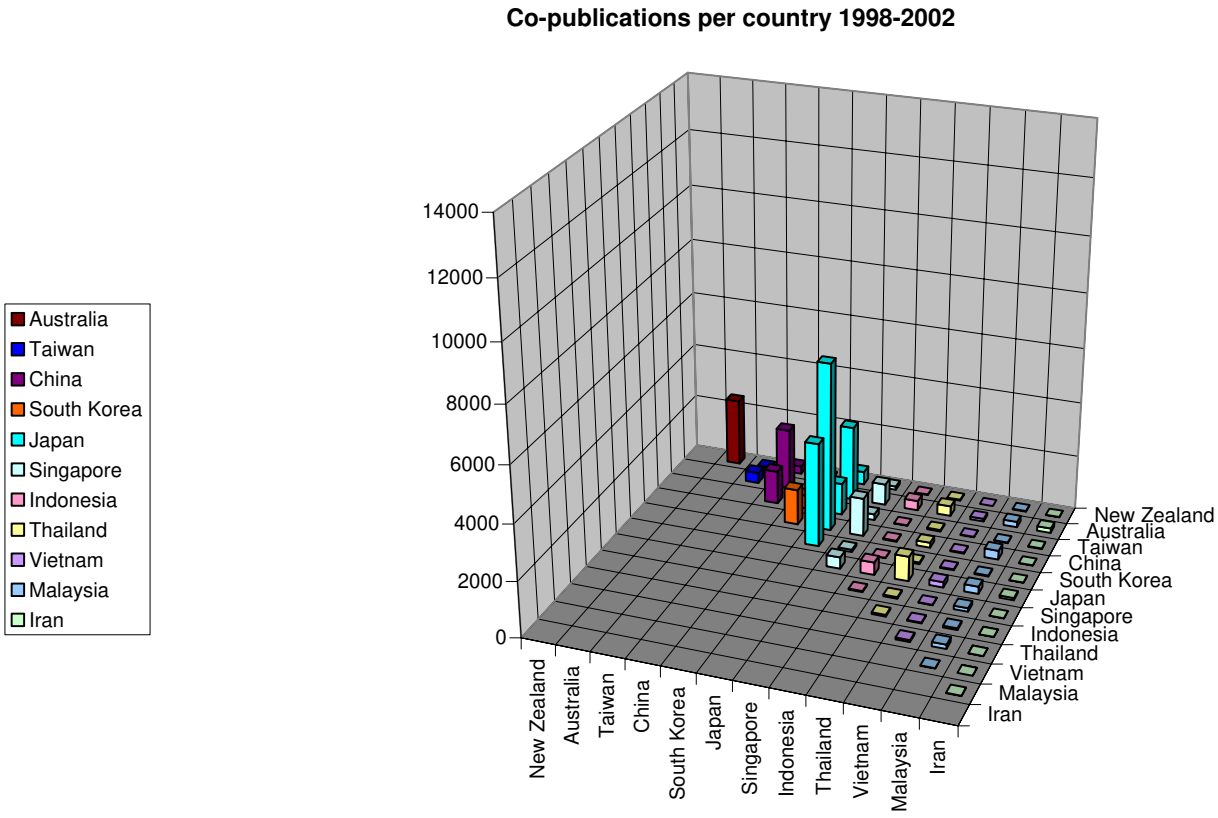

Figure 19: Number of co-publications per country for the period 1998-2002

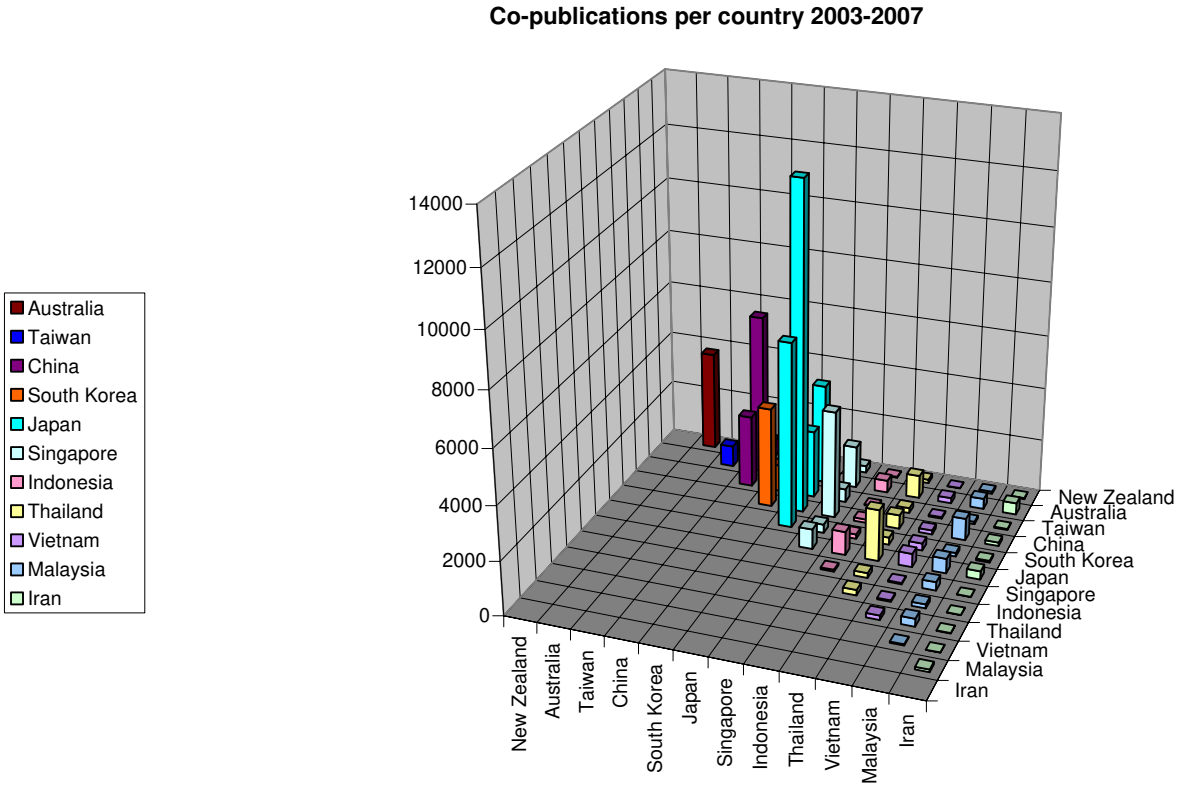

Figure 20: Number of co-publications per country for the period 2003-2007

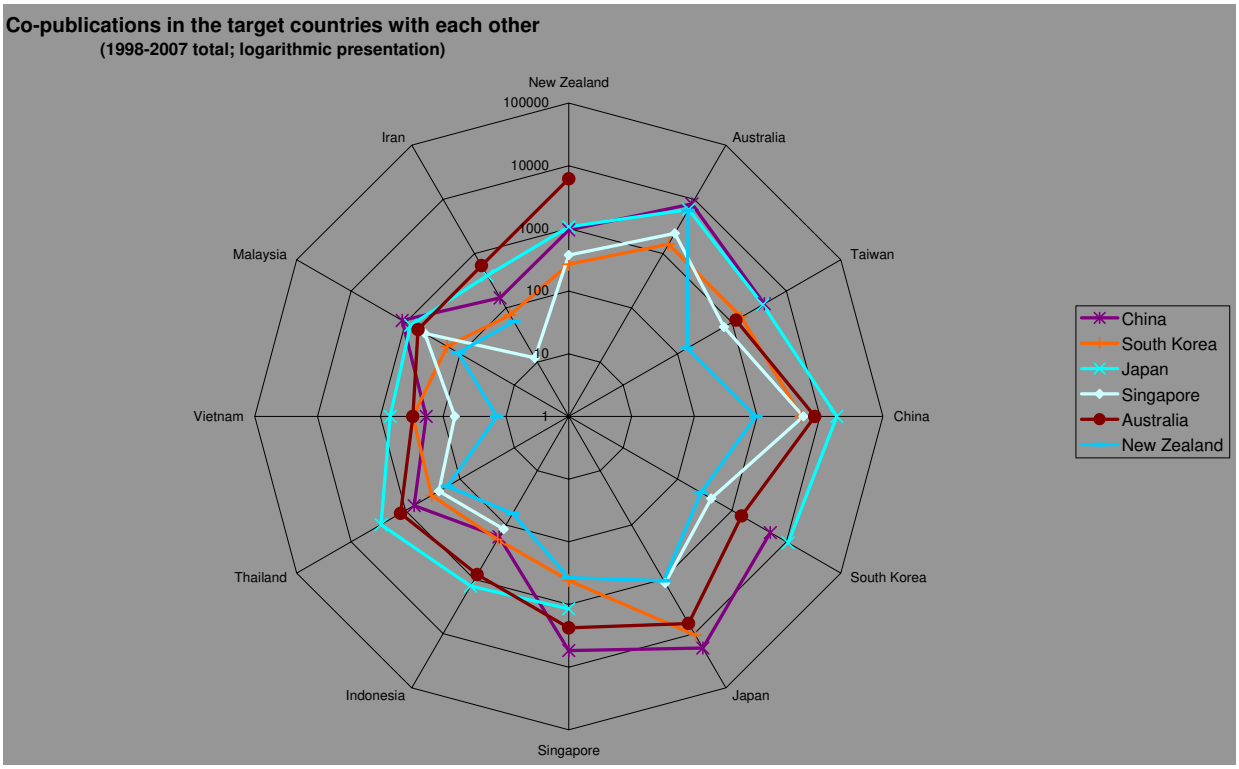

Figure 21: Number of co-publications per country for the period 1998-2007

The spider charts in Figures 21 and 22 also display the total number of co-publications for the countries studied, as did Figure 18. It should be noted that a logarithmic scale was used in the spider charts. Due to the large number of countries involved and the huge differences between them, we split them between two diagrams in order to provide a better overview.

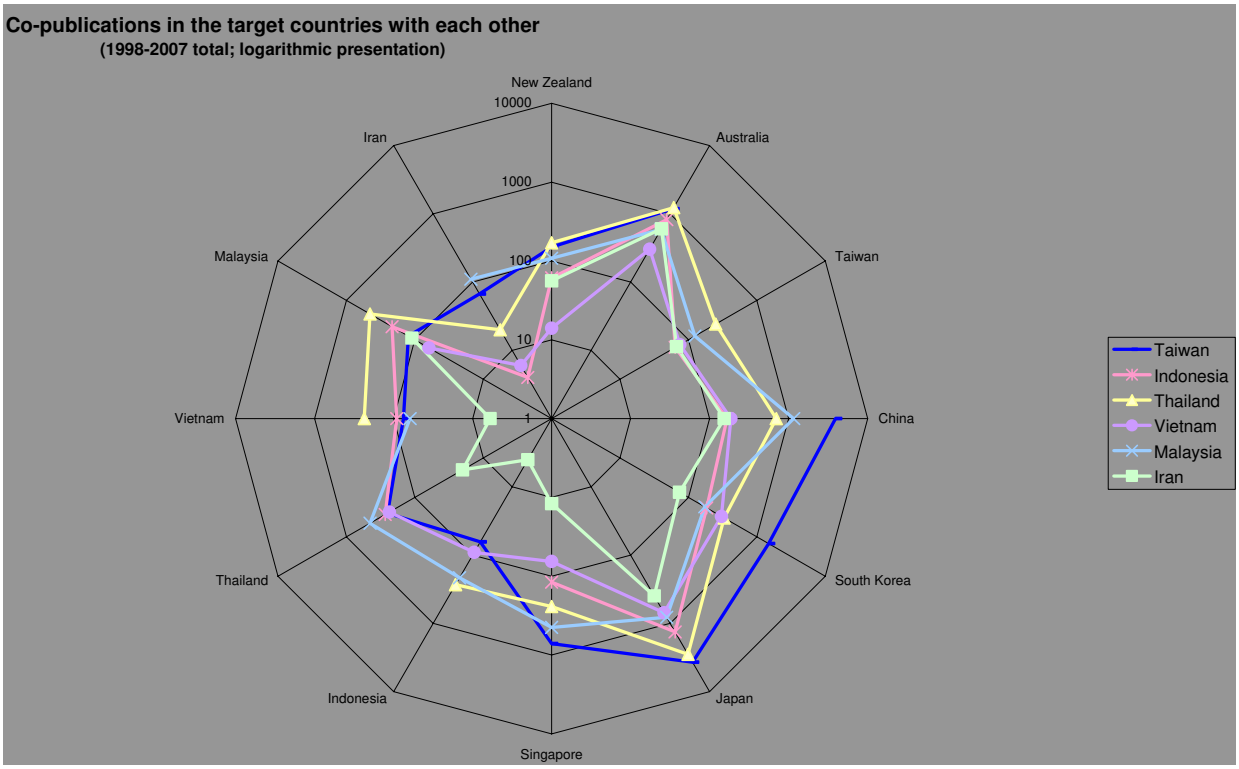

Figure 22: Number of co-publications per country for the period 1998-2007

Figures 23 – 34 illustrate the co-publication activity of the countries with each other over time. The EU-27 serves as a benchmark. By presenting the data in this manner, we can see how scientific cooperations with the other countries studied have developed from each country's perspective. In general, the more a country publishes, the more it cooperates on an international level.

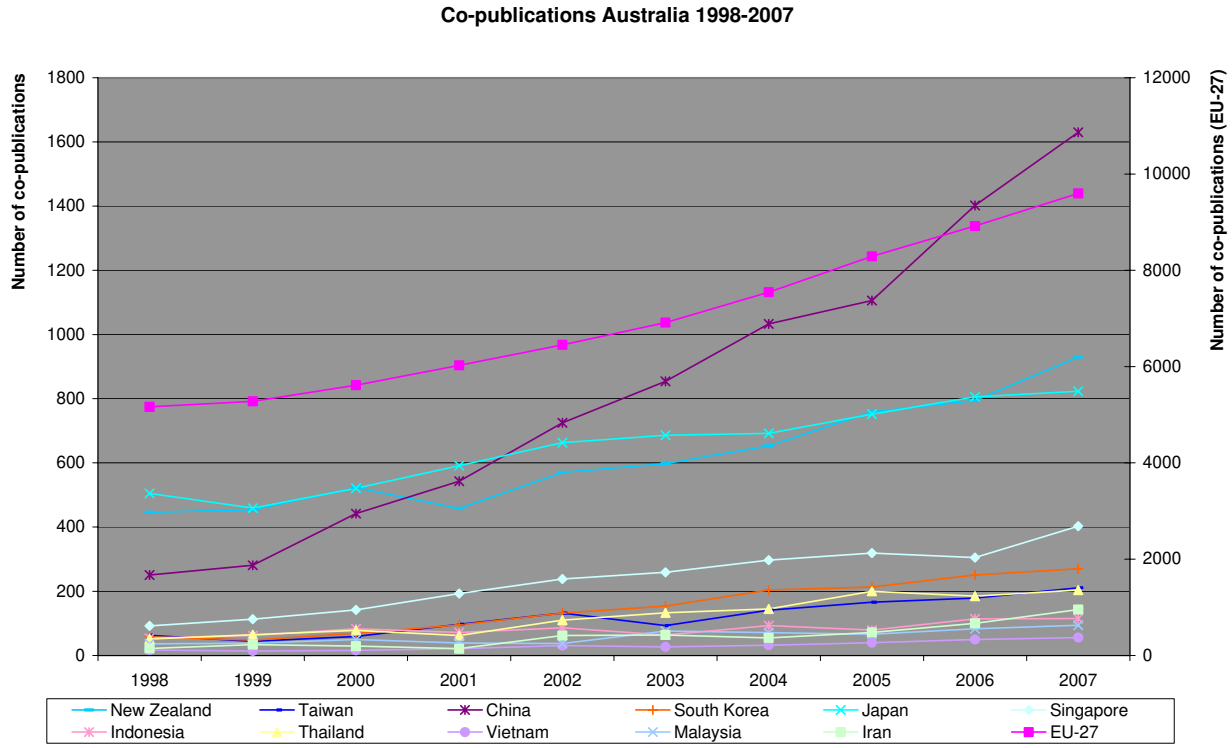

Figure 23: Co-publications by Australia over time; the most important cooperation partners are China, Japan and New Zealand.

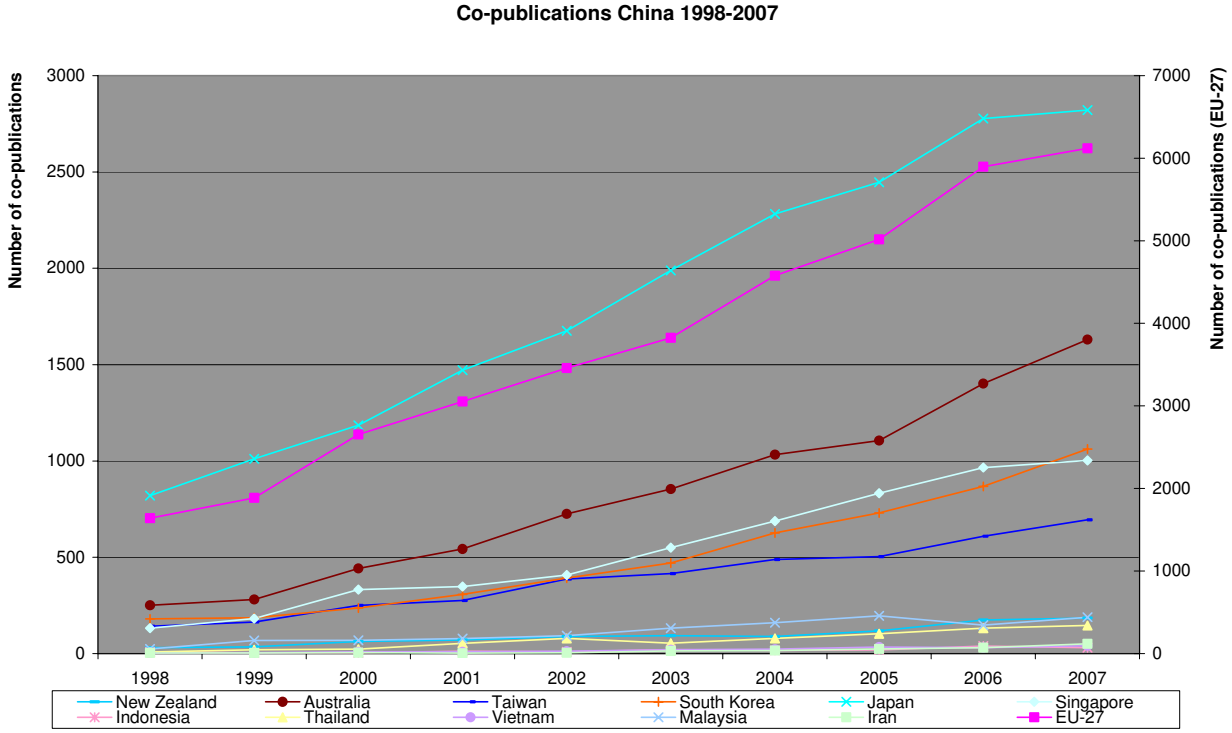

Figure 24: Co-publications by China over time; the most important cooperation partners are Japan, Australia, Singapore and South Korea.

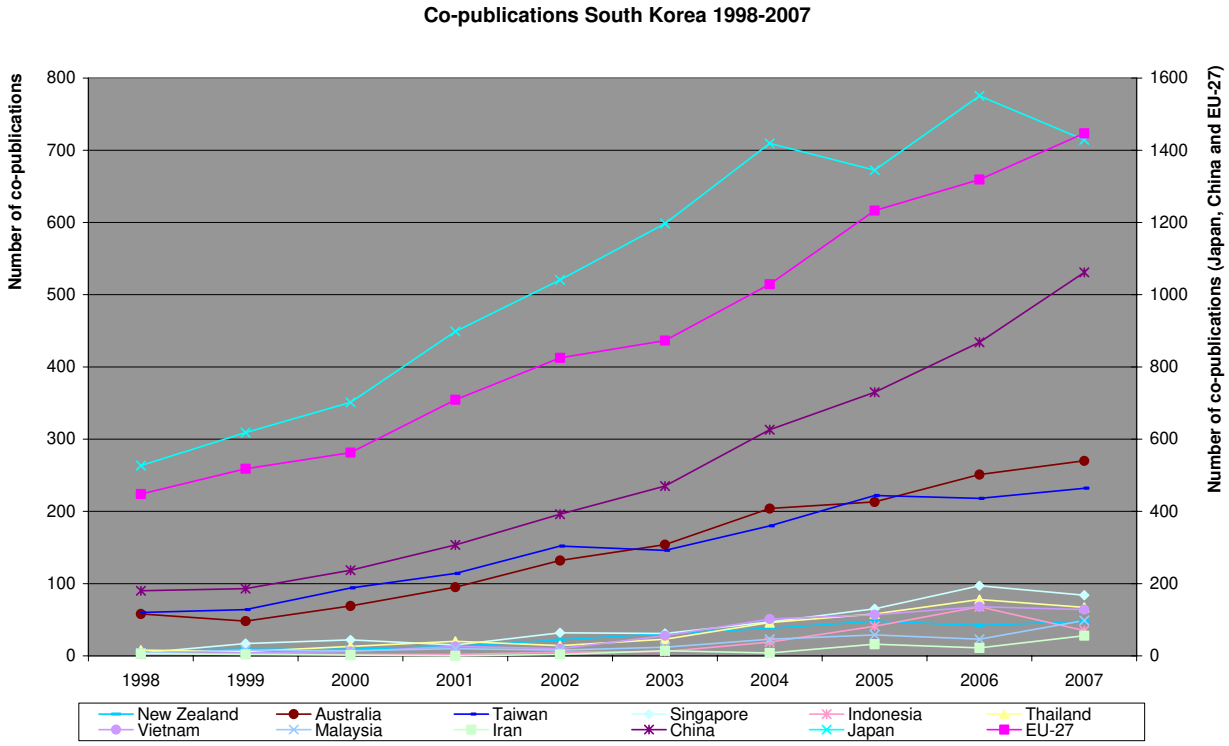

Figure 25: Co-publications by South Korea over time; the most important cooperation partners are Japan and China.

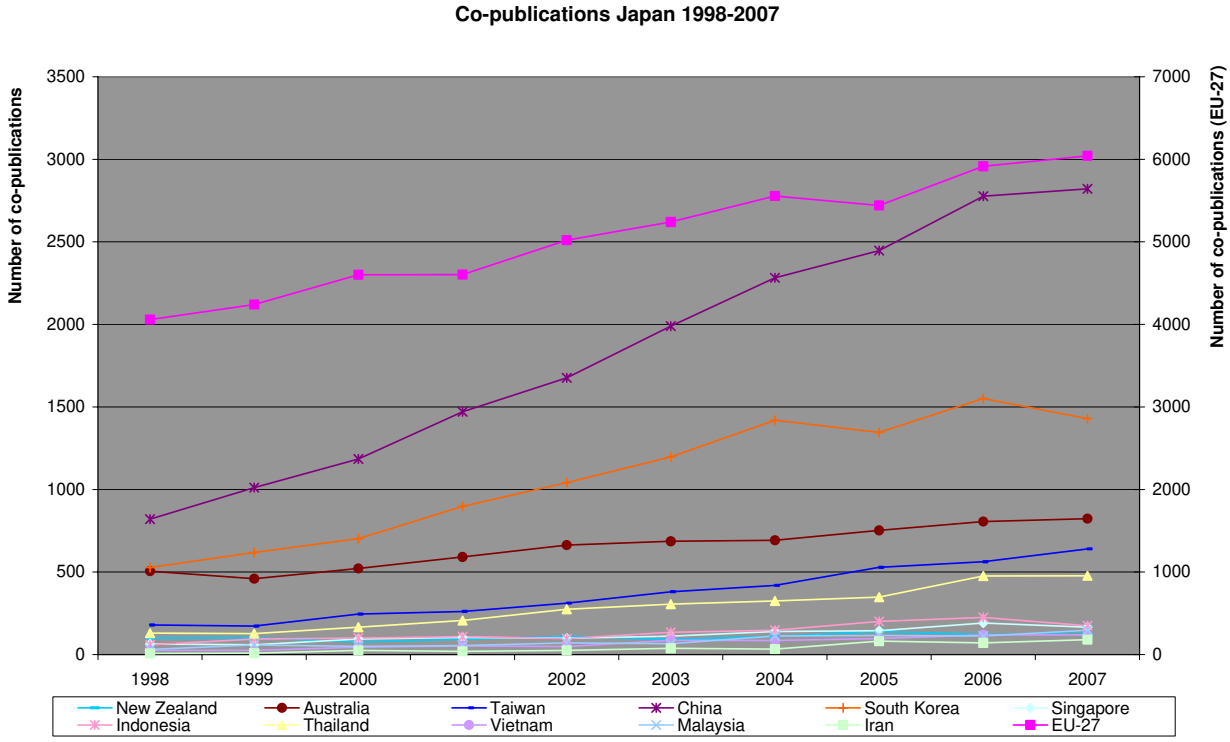

Figure 26: Co-publications by Japan over time; the most important cooperation partners are China, South Korea and Australia.

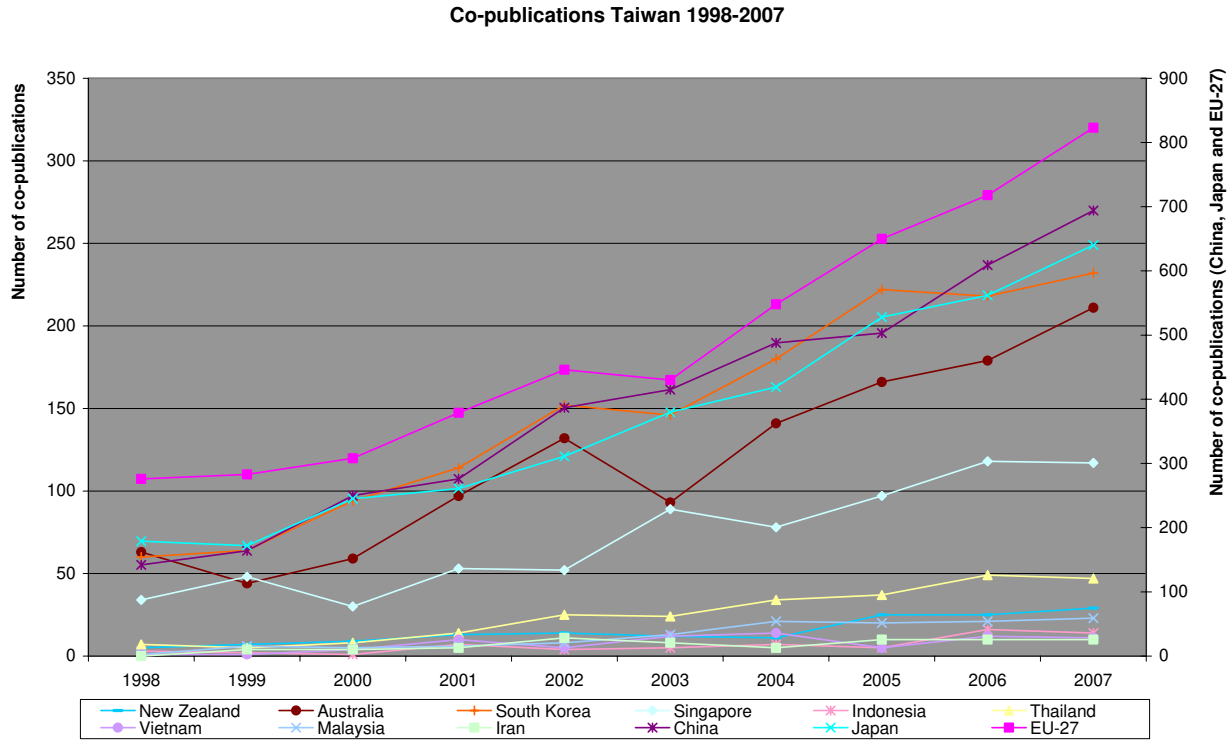

Figure 27: Co-publications by Taiwan over time; the most important cooperation partners are China and Japan.

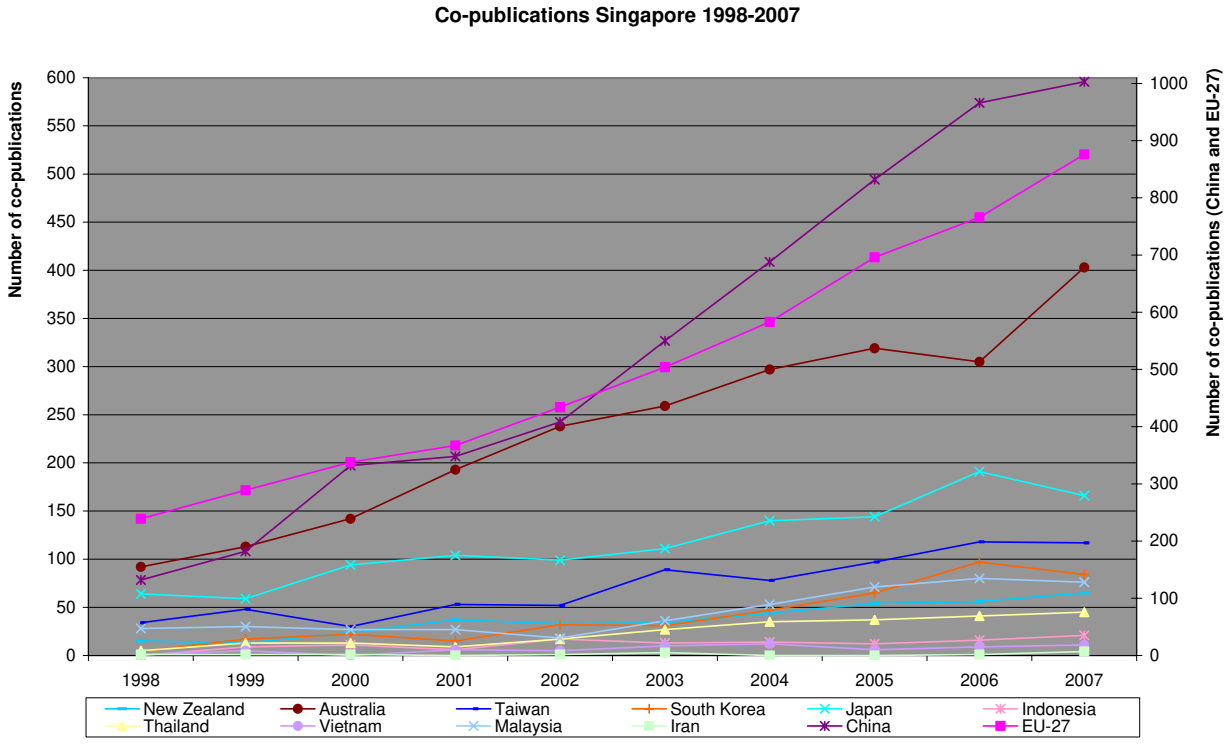

Figure 28: Co-publications by Singapore over time; the most important cooperation partner is China.

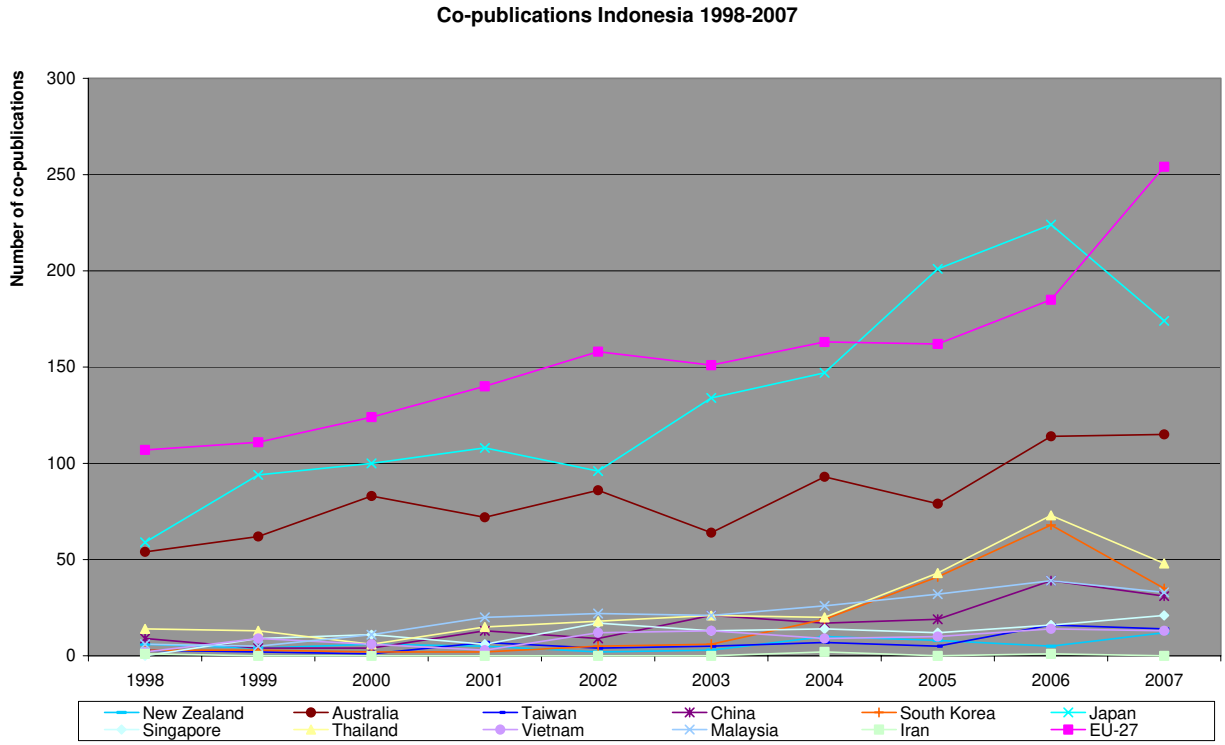

Figure 29: Co-publications by Indonesia over time; the most important cooperation partners are Japan and Australia.

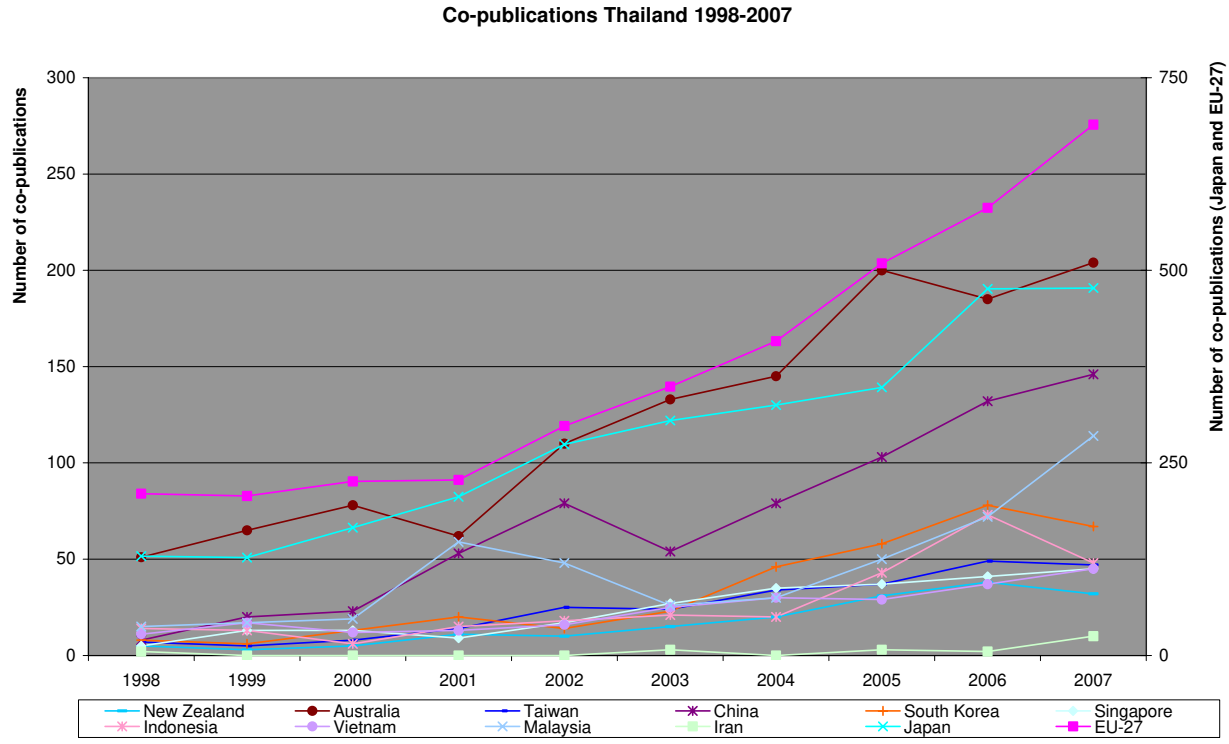

Figure 30: Co-publications by Thailand over time; the most important cooperation partners are Japan, Australia and China.

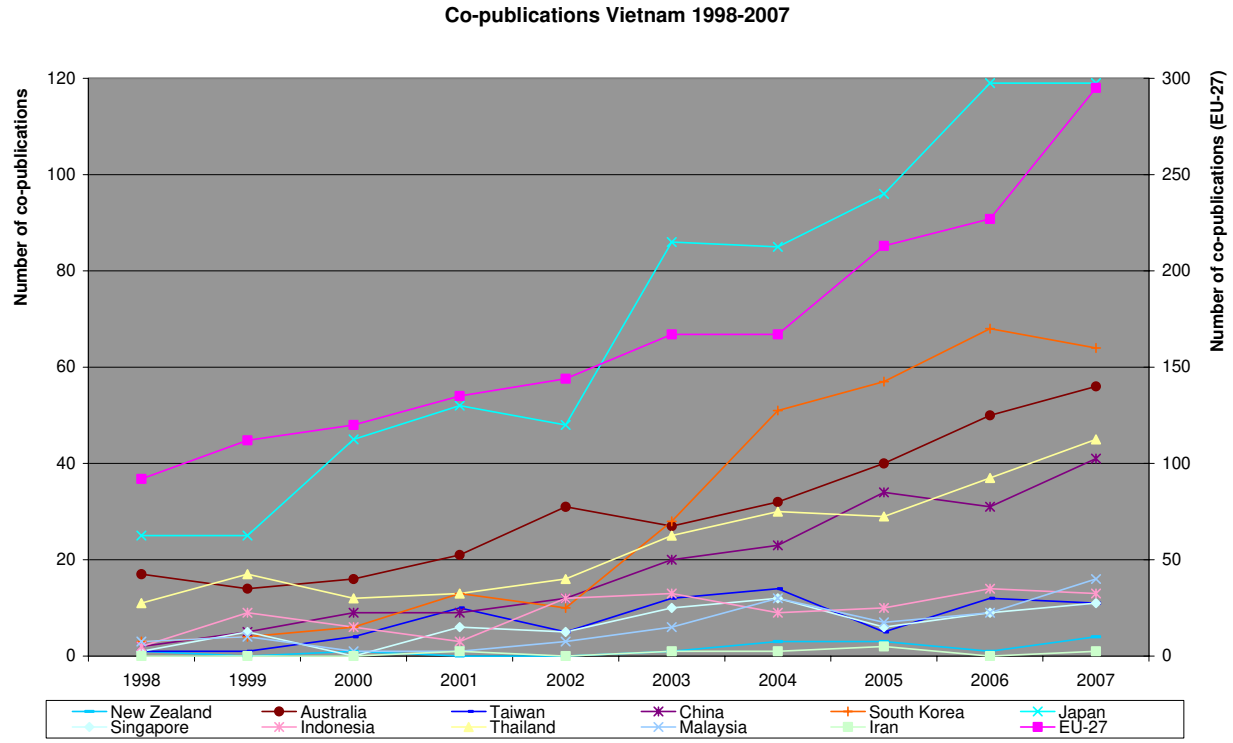

Figure 31: Co-publications by Vietnam over time; the most important cooperation partners are Japan, Australia, Thailand and China. South Korea has experienced a strong increase over the last five years.

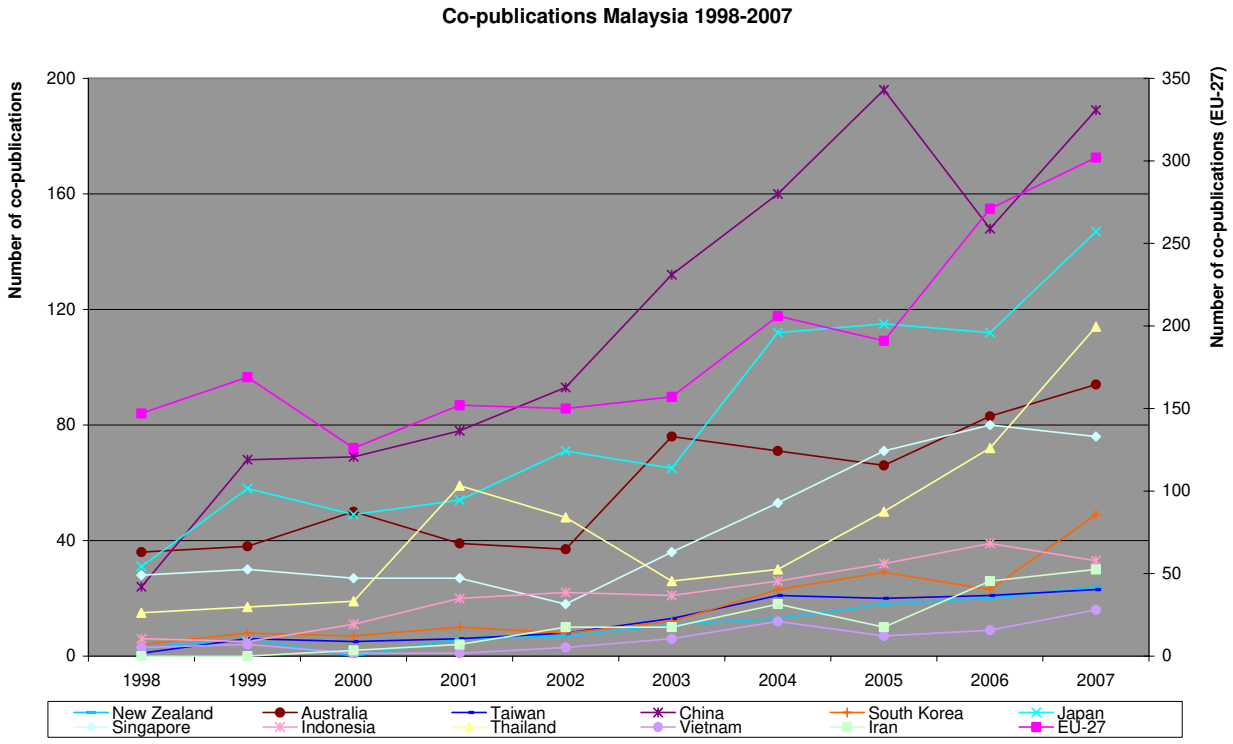

Figure 32: Co-publications by Malaysia over time; the most important cooperation partners are China, Japan, Australia, Thailand and Singapore.

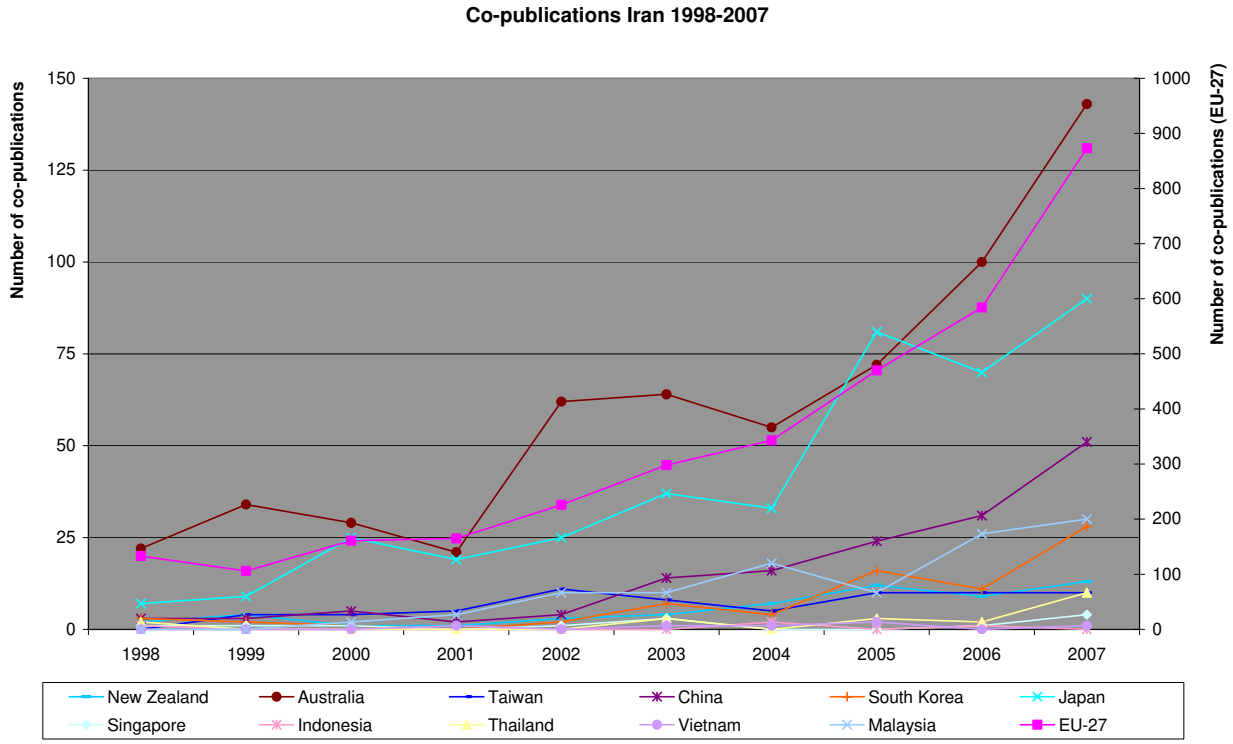

Figure 33: Co-publications by Iran over time; the most important cooperation partners are Australia and Japan.

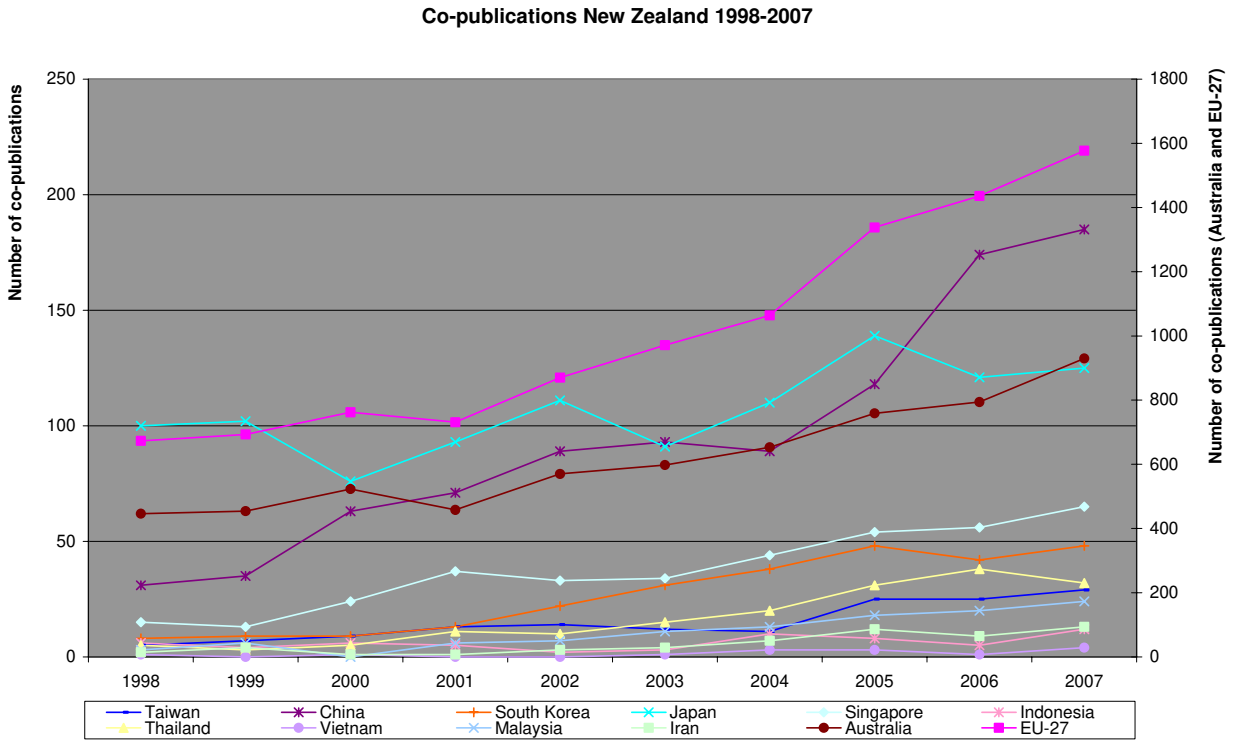

Figure 34: Co-publications by New Zealand over time; the most important cooperation partner is Australia.

Co-publications by the countries studied with each other

	New Zealand	Australia	Taiwan	China	South Korea	Japan	Singapore	Indonesia	Thailand	Vietnam	Malaysia	Iran
New Zealand		2451	48	289	61	482	122	23	34	2	22	11
Australia	2451		395	2242	402	2739	778	357	366	99	200	168
Taiwan	48	395		1219	484	1168	217	17	59	21	26	24
China	289	2242	1219		1302	6163	1402	39	183	37	332	17
South Korea	61	402	484	1302		3786	90	15	61	36	37	8
Japan	482	2739	1168	6163	3786		420	457	902	195	263	85
Singapore	122	778	217	1402	90	420		43	57	17	130	4
Indonesia	23	357	17	39	15	457	43		66	32	64	1
Thailand	34	366	59	183	61	902	57	66		69	158	2
Vietnam	2	99	21	37	36	195	17	32	69		12	1
Malaysia	22	200	26	332	37	263	130	64	158	12		16
Iran	11	168	24	17	8	85	4	1	2	1	16	

Table 4: Total co-publications 1998-2002. In each column, the largest number is written in blue. Japan is most frequently the most important cooperation partner (for six countries), followed by China (four times) and Australia (twice).

	New Zealand	Australia	Taiwan	China	South Korea	Japan	Singapore	Indonesia	Thailand	Vietnam	Malaysia	Iran
New Zealand		3734	102	659	207	586	253	38	136	12	86	45
Australia	3734		790	6025	1092	3759	1583	465	867	205	390	434
Taiwan	102	790		2709	998	2529	499	47	191	54	98	43
China	659	6025	2709		3756	12316	4039	127	514	149	825	136
South Korea	207	1092	998	3756		6941	324	169	272	268	136	66
Japan	586	3759	2529	12316	6941		752	880	1931	505	551	311
Singapore	253	1583	499	4039	324	752		76	185	48	316	8
Indonesia	38	465	47	127	169	880	76		205	59	151	3
Thailand	136	867	191	514	272	1931	185	205		166	292	18
Vietnam	12	205	54	149	268	505	48	59	166		50	5
Malaysia	86	390	98	825	136	551	316	151	292	50		94
Iran	45	434	43	136	66	311	8	3	18	5	94	

Table 5: Total co-publications 2003-2007. In each column, the largest number is written in red and – where it is different – the largest value from Table 4 is written in blue. The priorities of the cooperations are generally the same. The only difference is that China is now the most important cooperation partner for Australia in this table of countries (1998 to 2002: Japan).

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2. Publication Analysis Based on Research Disciplines

2.1 Publication Activity of Selected Countries

In Chapter 2, we will no longer look at the nations as whole entities as we did in the previous chapter. Instead, we will split the scientific publication output into individual disciplines[8] . The disciplines are based on the classification of journals in the Science Citation Index on the basis of what it has termed “subject categories”. Therefore, classification does not occur on the basis of the content of each article, but rather on the basis of the publishing journal. A journal does not have to be assigned to one single subject category; it can be assigned multiple categories. The approximately 6,400 scientific journals in the Science Citation Index are assigned to around 170 subject categories.

The following evaluations use the disciplines as a basis and assume that thematically similar categories are covered by the one discipline. Figures 35 to 38 illustrate the absolute number of articles per discipline for the period 1998 to 2007. It is not possible to add the values of individual disciplines for each country in the charts or tables that follow. As a result of multiple classifications, there are overlaps between the disciplines that disallow a summation. For example, publications in the journal “Chemical Physics – Physical Chemistry” are assigned to both chemistry and physics, and would therefore be counted twice in a summation. From the charts, we can see the key disciplines in which each country publishes, taking into account the fact that the Science Citation Index has a different focus in terms of disciplines covered.

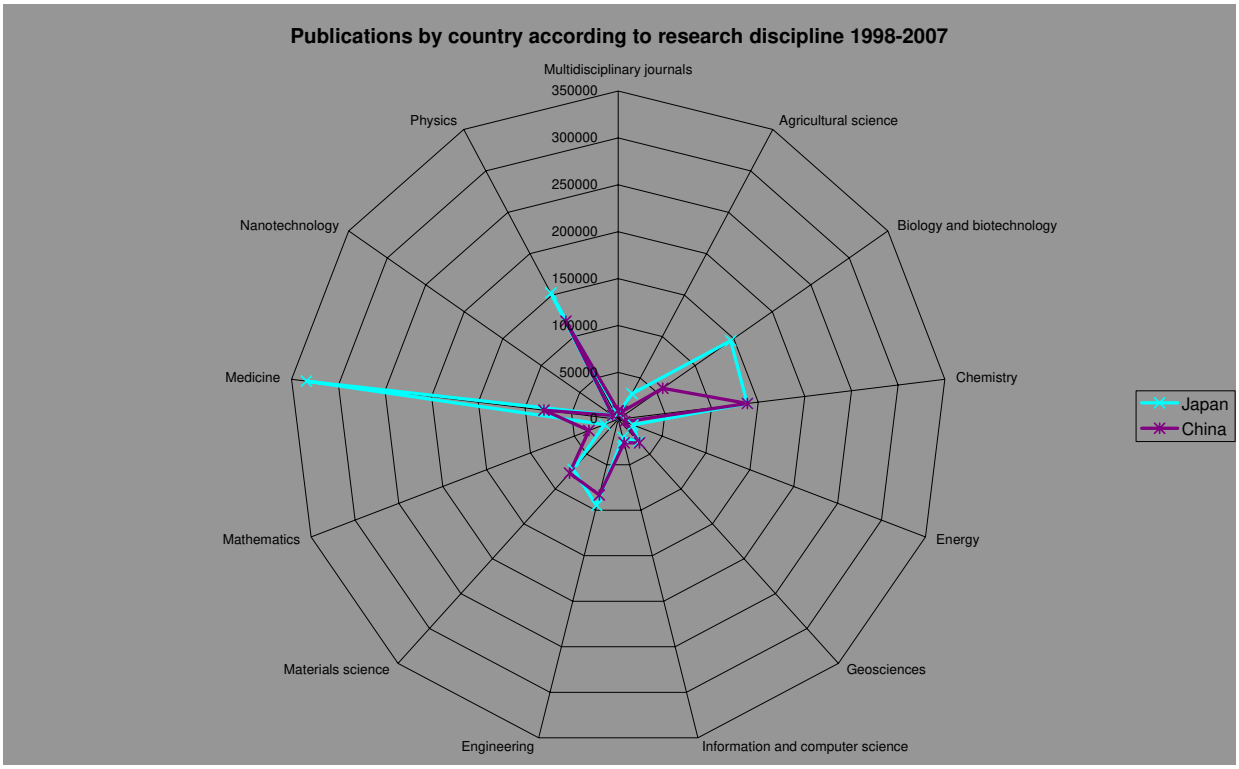

Figure 35: Publications by the countries studied 1998 – 2007 according to research discipline

[8] The disciplines are: agricultural science, biology and biotechnology, chemistry, energy, geosciences, information and computer science, engineering, materials science, mathematics, medicine, nanotechnology, physics and multidisciplinary journals. Multidisciplinary journals include journals such as Science and Nature.

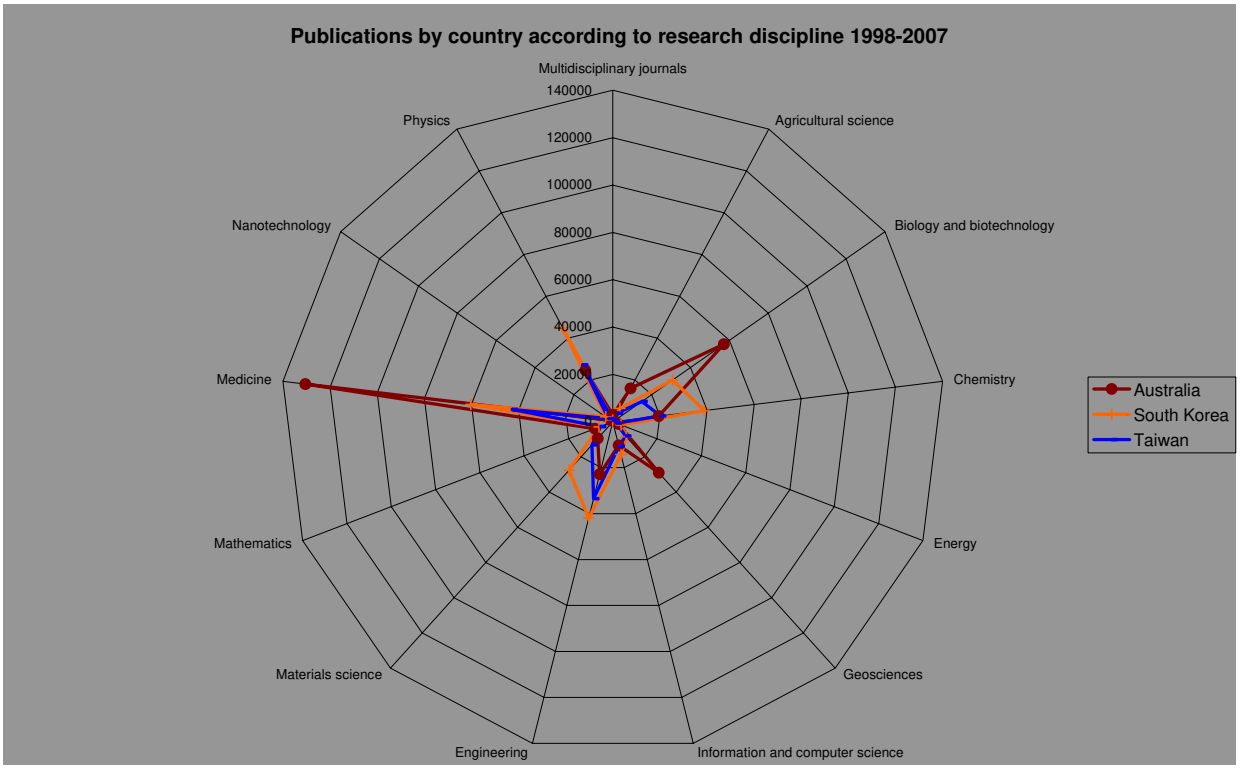

Figure 36: Publications by the countries studied 1998 – 2007 according to research discipline

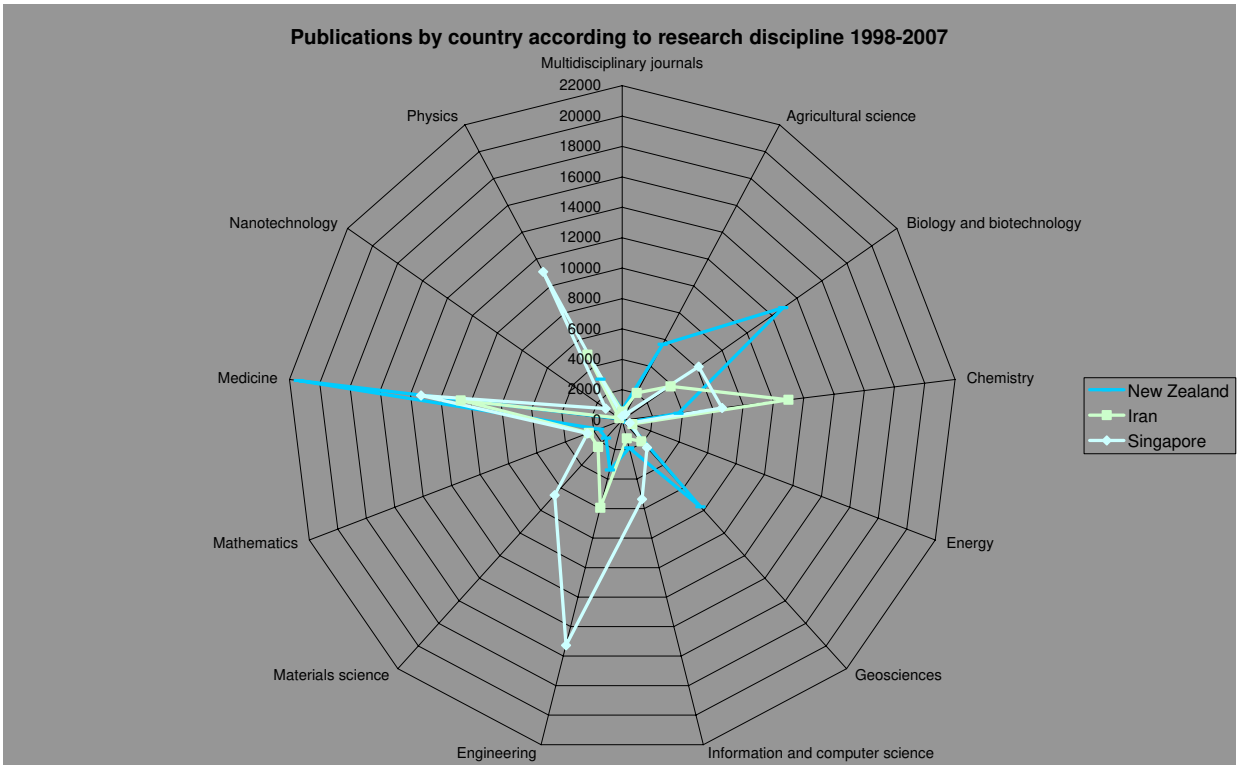

Figure 37: Publications by the countries studied 1998 – 2007 according to research discipline

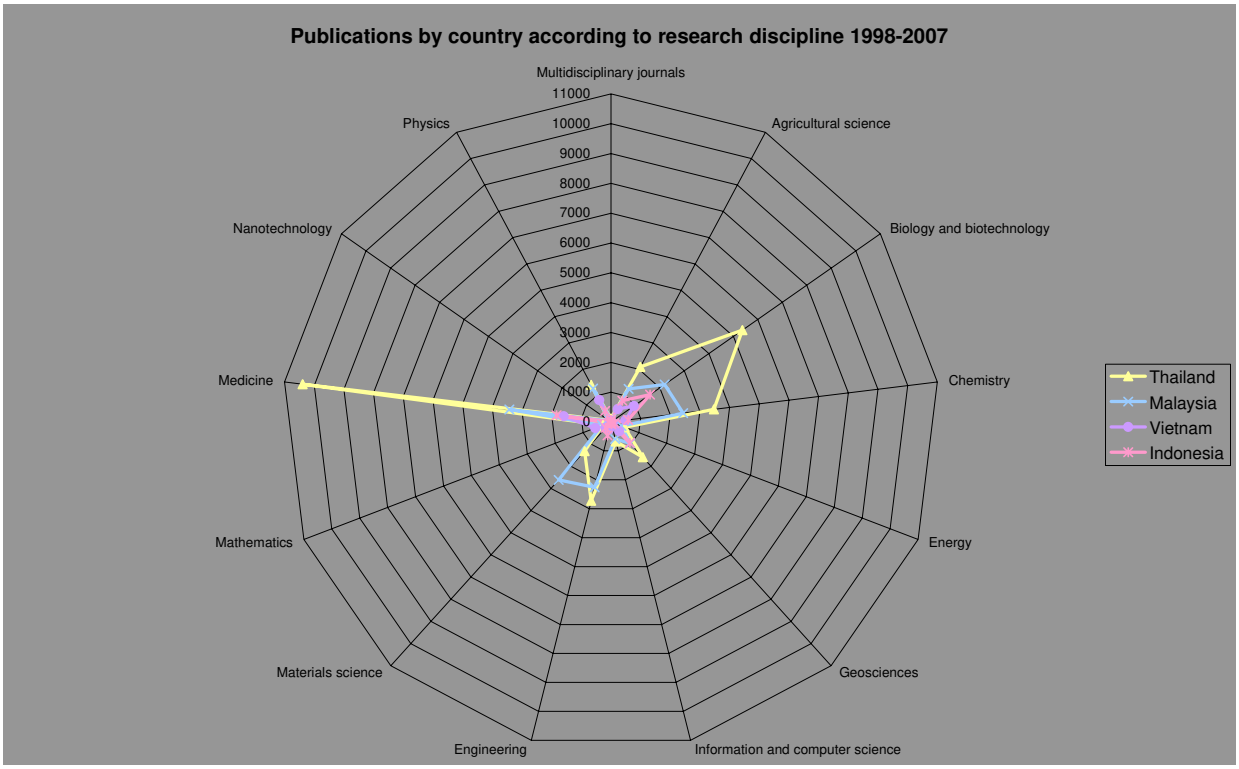

Figure 38: Publications by the countries studied 1998 – 2007 according to research discipline

Approximately one third of all articles in the Science Citation Index come from medicine. This is the reason why medicine is the field with the highest number of publications in many but not all of the countries, as shown in Figures 35 to 38. In China, for example, physics and chemistry represent a significantly higher proportion of the total number of publications compared to medicine. The same is true of engineering in Singapore, which is much more strongly pronounced than medicine, and of chemistry in Iran.

The next page provides a summary of the absolute number of publications by each country per discipline for the entire period under review here.

Number of publications according to discipline	Germany	China	Japan	New Zealand	Australia	Taiwan	South Korea	Singapore	Indonesia	Thailand	Vietnam	Malaysia	Iran
Multidisciplinary journals	8242	9178	5755	689	2923	548	688	268	71	118	41	89	558
Agricultural science	19571	9418	30932	5648	15919	4045	6367	442	811	2089	490	1260	2029
Biology and biotechnology	134364	57819	146100	12901	57112	14949	30763	6124	1599	5367	934	2192	3874
Chemistry	105552	138332	138083	3720	19494	20199	38858	6596	579	3470	493	2430	10987
Energy	13914	7432	16745	392	2616	1657	3772	525	119	489	63	372	713
Geosciences	45389	33861	32526	7668	28960	8077	8513	2432	944	1591	416	964	1875
Information and computer science	26745	25954	19669	1889	10284	10679	14285	5360	78	679	124	584	1234
Engineering	61664	83193	94708	3381	22855	33501	41908	15265	469	2722	261	2257	5939
Materials science	48258	77351	71677	1591	9445	13183	27507	6640	260	1312	268	2612	2366
Mathematics	25529	33460	15467	1636	8070	5646	6205	2439	72	287	565	321	2345
Medicine	370187	79567	334060	21388	130479	42717	60263	13307	1831	10388	1589	3423	10677
Nanotechnology	6110	7107	7320	151	995	2285	3631	1322	8	92	10	64	237
Physics	149494	118574	152617	3049	24623	27219	44921	11048	417	1410	833	1270	4877
Total	1015019	681246	1065659	64103	333775	184705	287681	71768	7258	30014	6087	17838	47711

Table 6: Number of publications by a country in a discipline. The largest number in a column is written in blue; the second-highest in red. This colour-code makes it clear in which discipline a country is most active. It also reveals that medicine is not the main field of scientific publication in China, Singapore and Iran as it is in the other countries studied.

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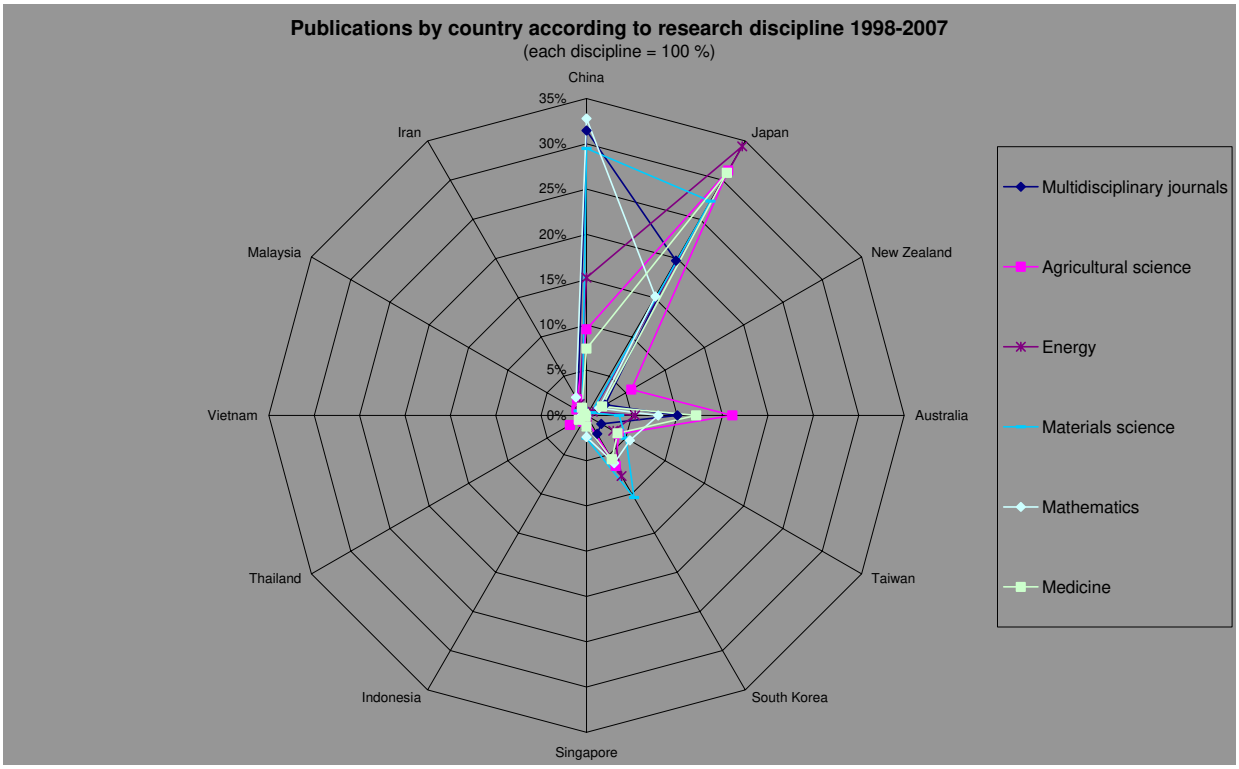

Figure 39: Publications by the countries studied in the disciplines of agricultural science, energy, materials science, mathematics, medicine and the multidisciplinary journals

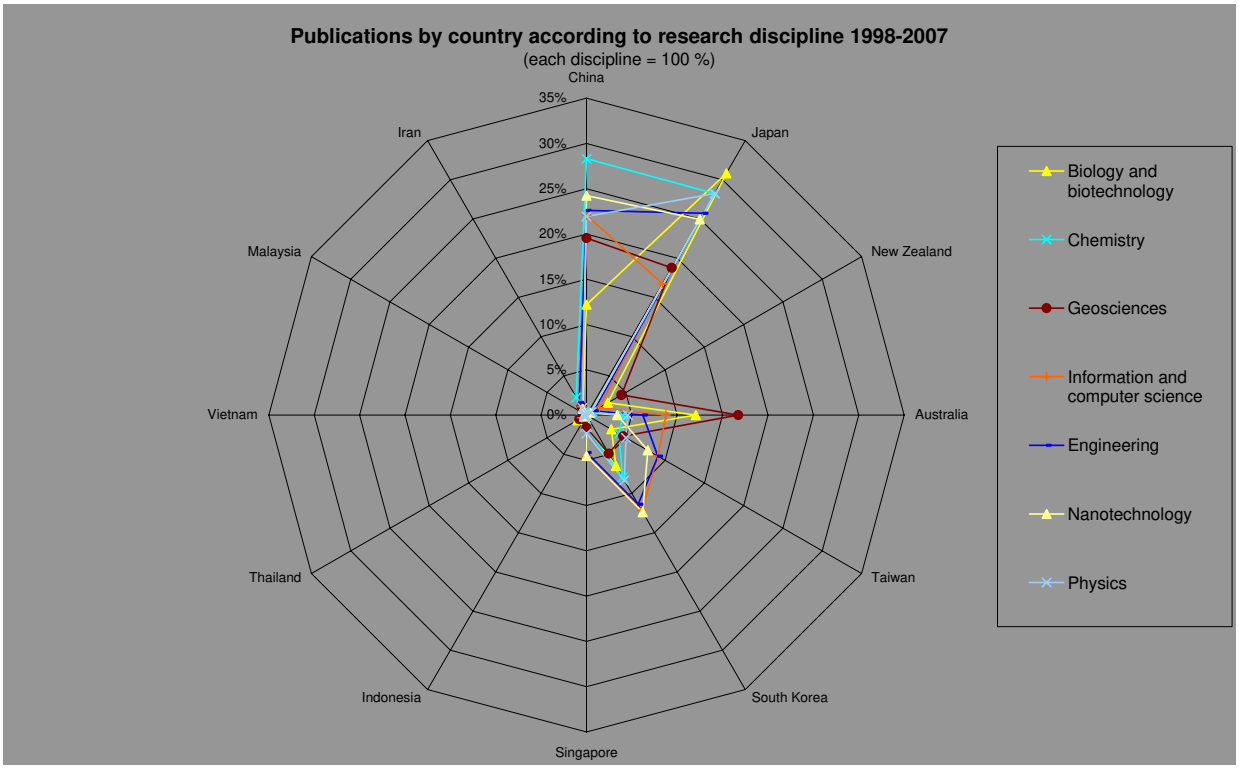

Figure 40: Publications by the countries studied in the disciplines of biology and biotechnology, chemistry, geosciences, information and computer science, engineering, nanotechnology and physics

Figures 39 and 40 reveal those countries that attain a certain level of activity in the individual disciplines. The output of all of the countries analysed in each discipline is taken here as 100 %. This allows us to determine, for example, that Japan is responsible for around 30 % of the

publications in biology and biotechnology, while China produces around 30 % of the publications evaluated for chemistry and mathematics.

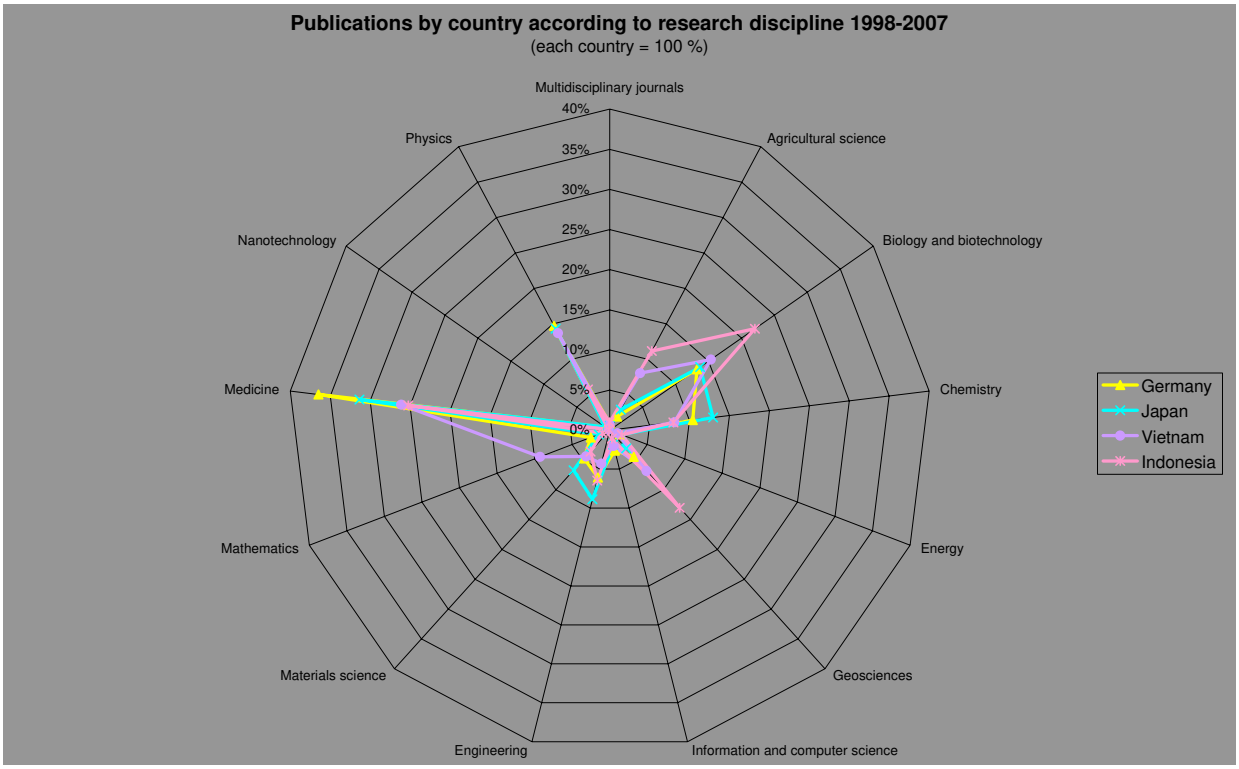

Figure 41: Publications by Germany, Japan, Vietnam and Indonesia according to research discipline

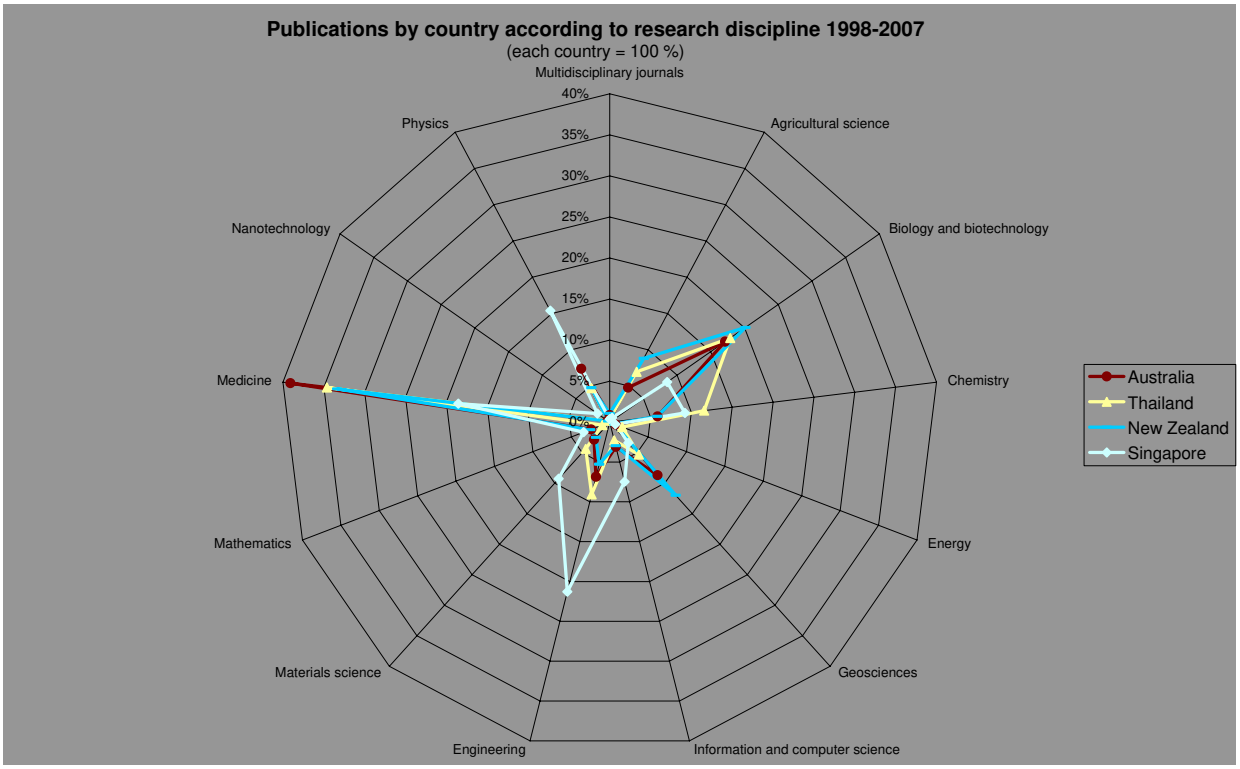

Figure 42: Publications by Australia, Thailand, New Zealand and Singapore according to research discipline

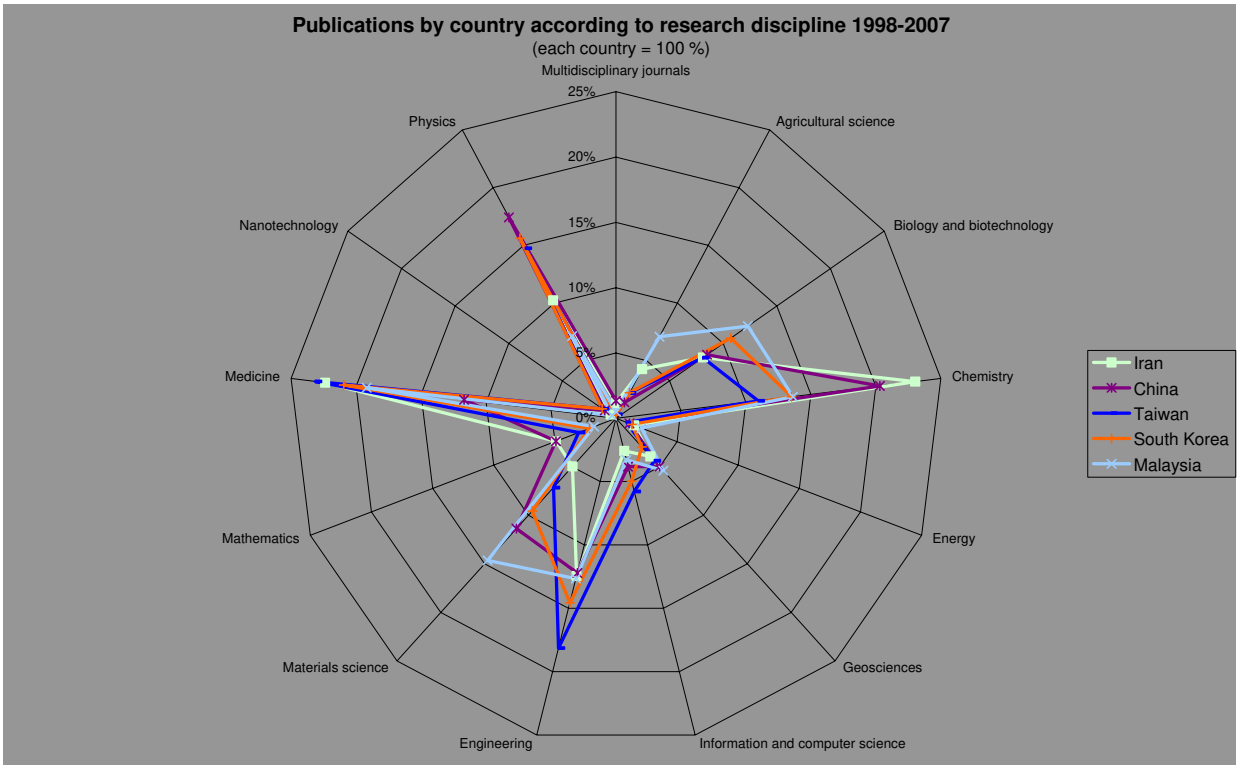

Figure 43: Publications by China, Taiwan, South Korea, Malaysia and Iran according to research discipline

Figures 41 to 43 are also concerned with the output of the countries in the disciplines. However, the output of each individual country is taken as 100 % for these analyses. This makes it possible to localise the particular priorities of individual and multiple countries. Since the primary emphasis of the database is the field of medicine, it is not surprising that a high proportion of the output of the majority of the countries studied here is also in this field. On the other hand, it is interesting to note that in Indonesia, for example, biology and biochemistry continue to be a priority, as does chemistry in Iran.

2.2 Growth Rates for Publication Activity

The growth rates for the production of articles in the individual disciplines provide information on the disciplines that experienced an increase or decrease in the number of articles produced between the two periods of 1998 to 2002 and 2003 to 2007. It should be noted that disciplines which produce a small number of articles will generate higher growth rates (e.g. in information and computer science). For this reason, the discipline of “nanotechnology” is not included in the following bar charts. The corresponding data, however, can be found in the tables that follow the bar charts.

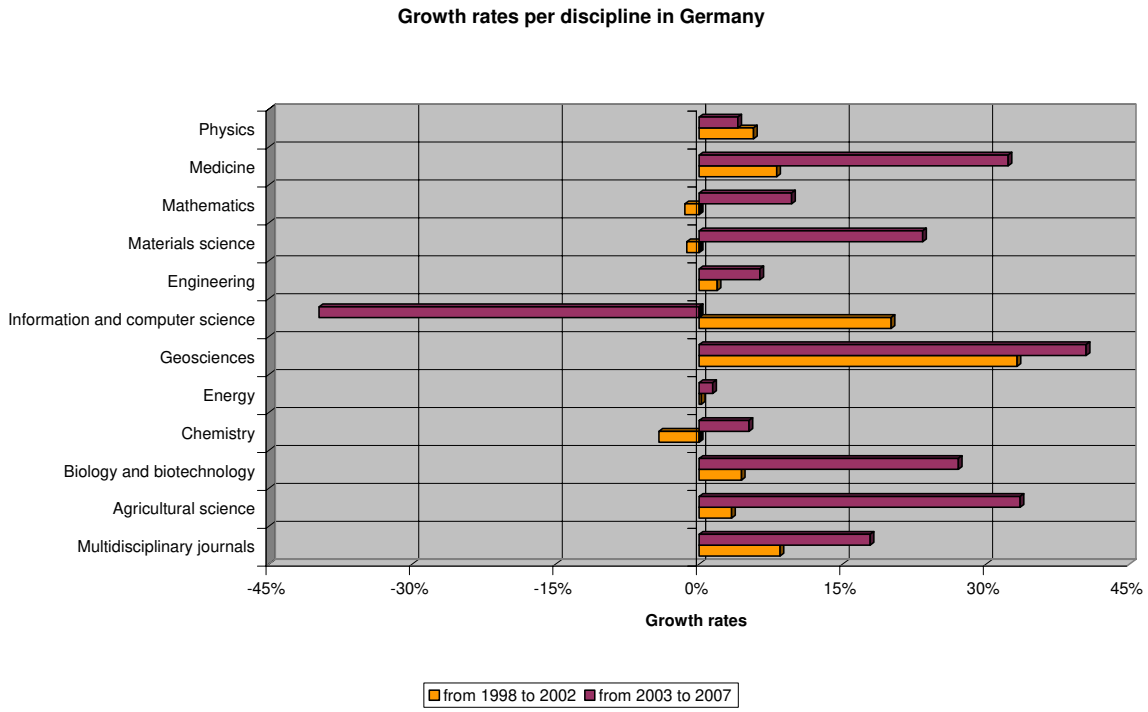

Figure 44: Growth rates of the output in individual disciplines (Germany)

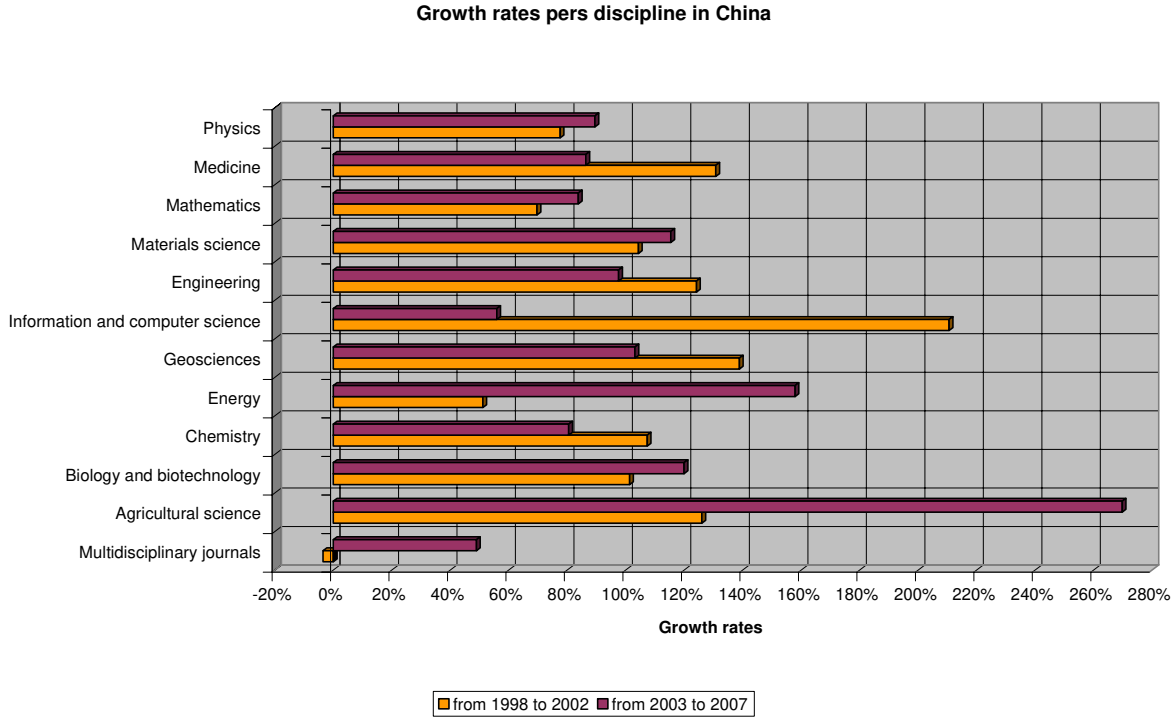

Figure 45: Growth rates of the output in individual disciplines (China)

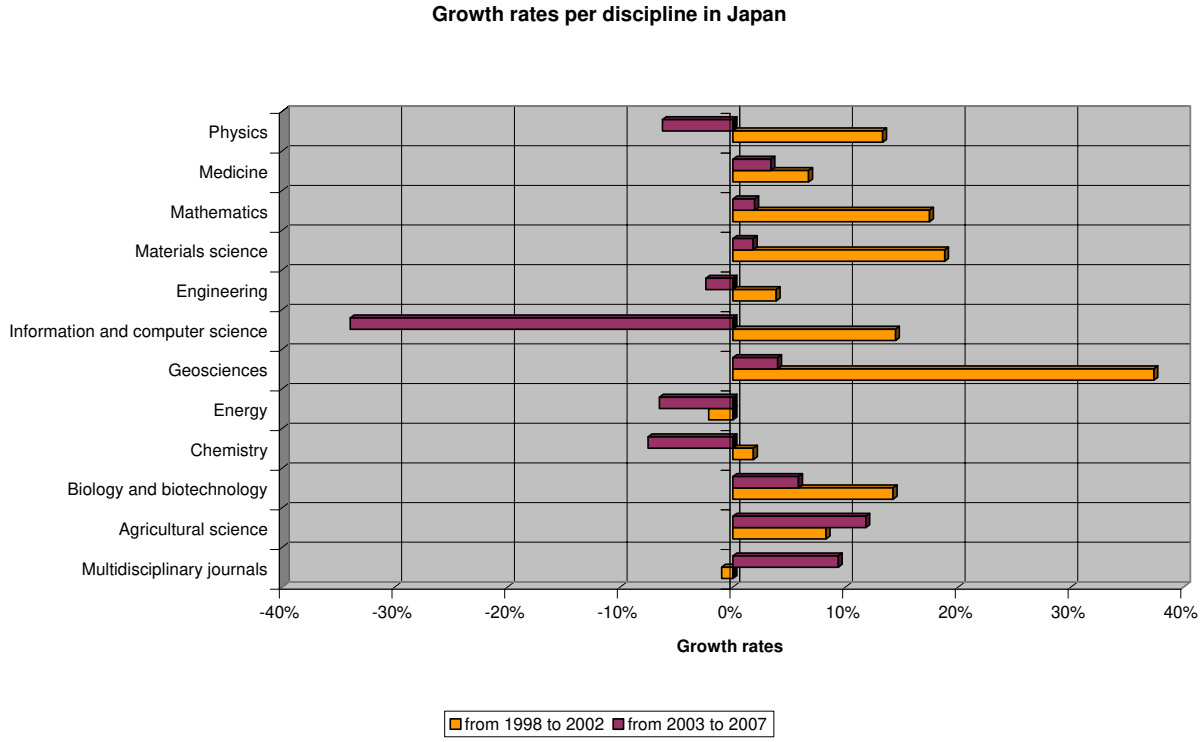

Figure 46: Growth rates of the output in individual disciplines (Japan)

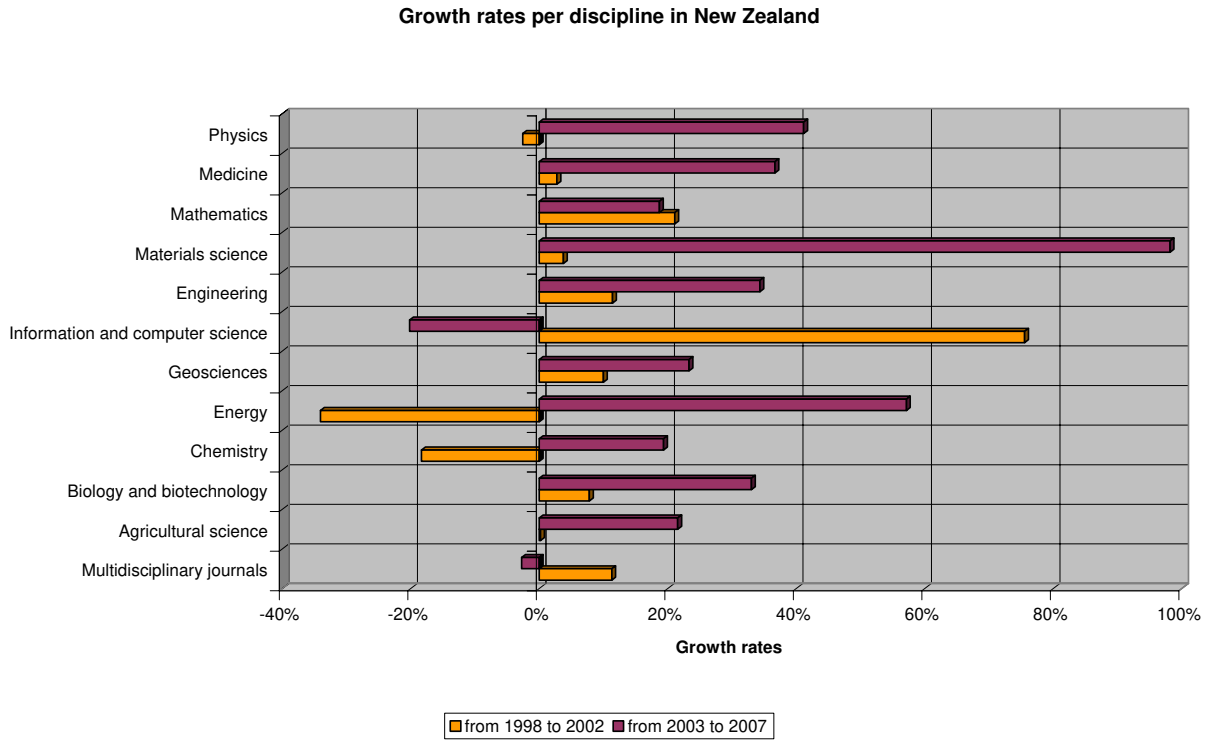

Figure 47: Growth rates of the output in individual disciplines (New Zealand)

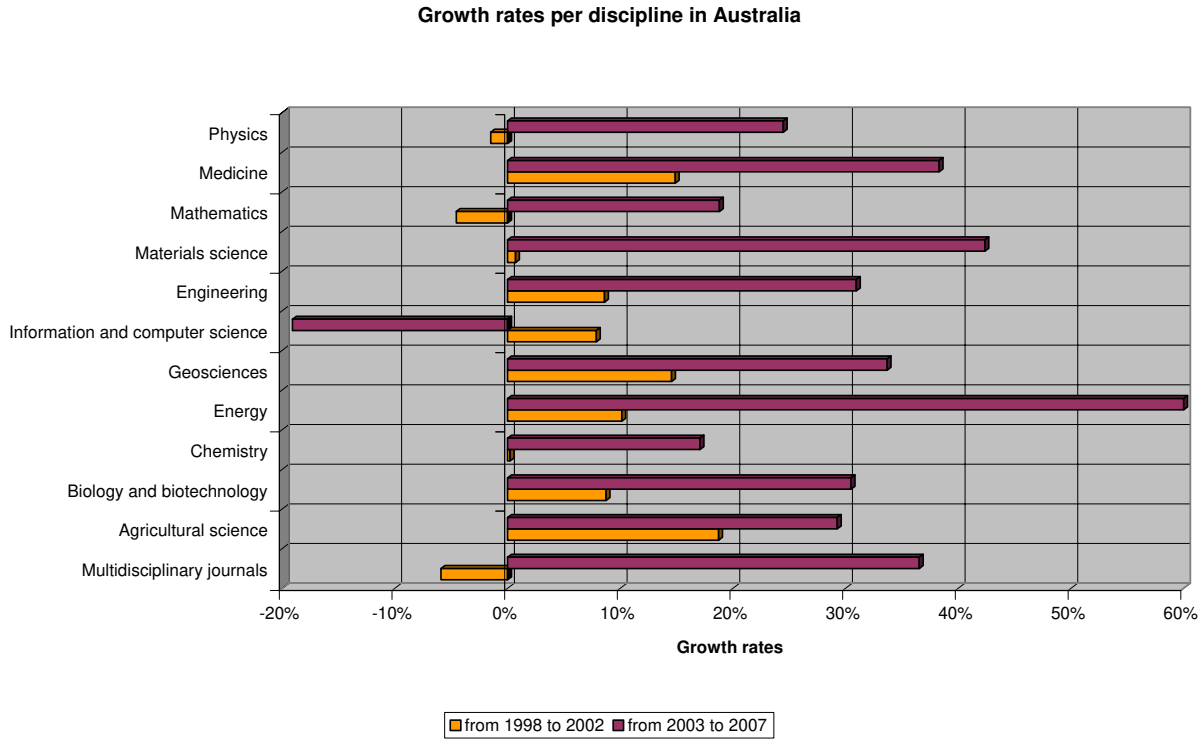

Figure 48: Growth rates of the output in individual disciplines (Australia)

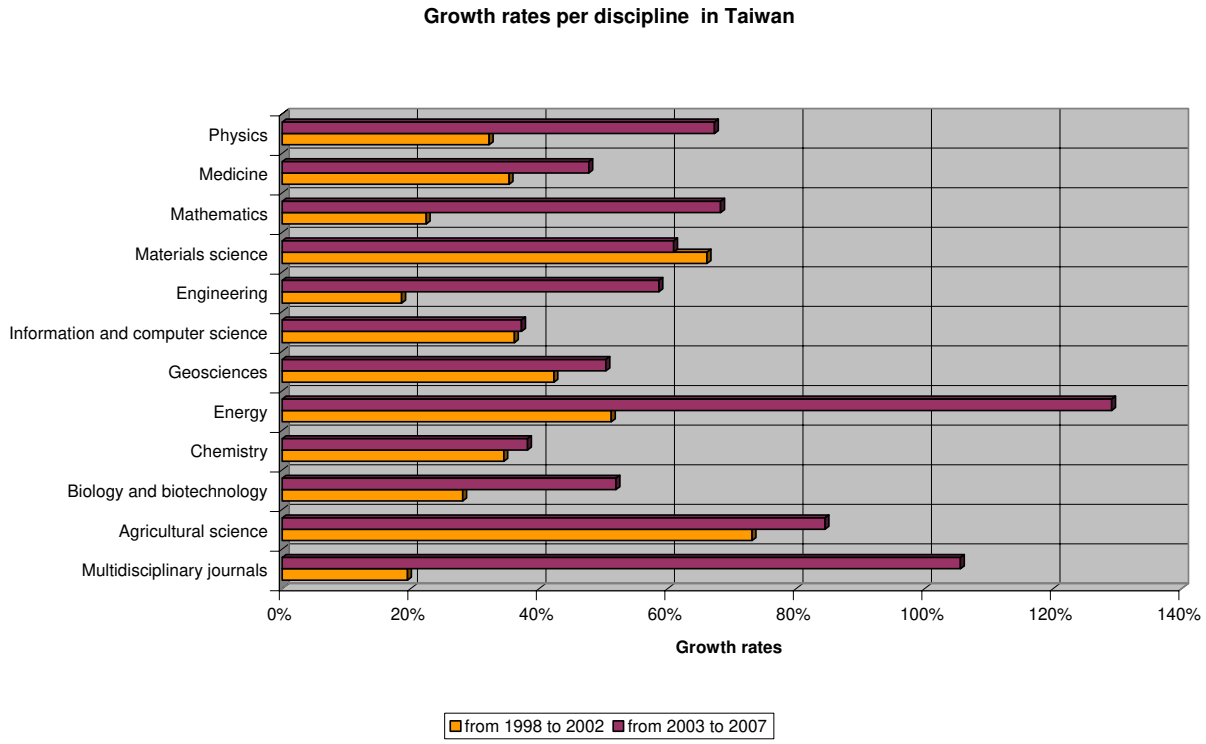

Figure 49: Growth rates of the output in individual disciplines (Taiwan)

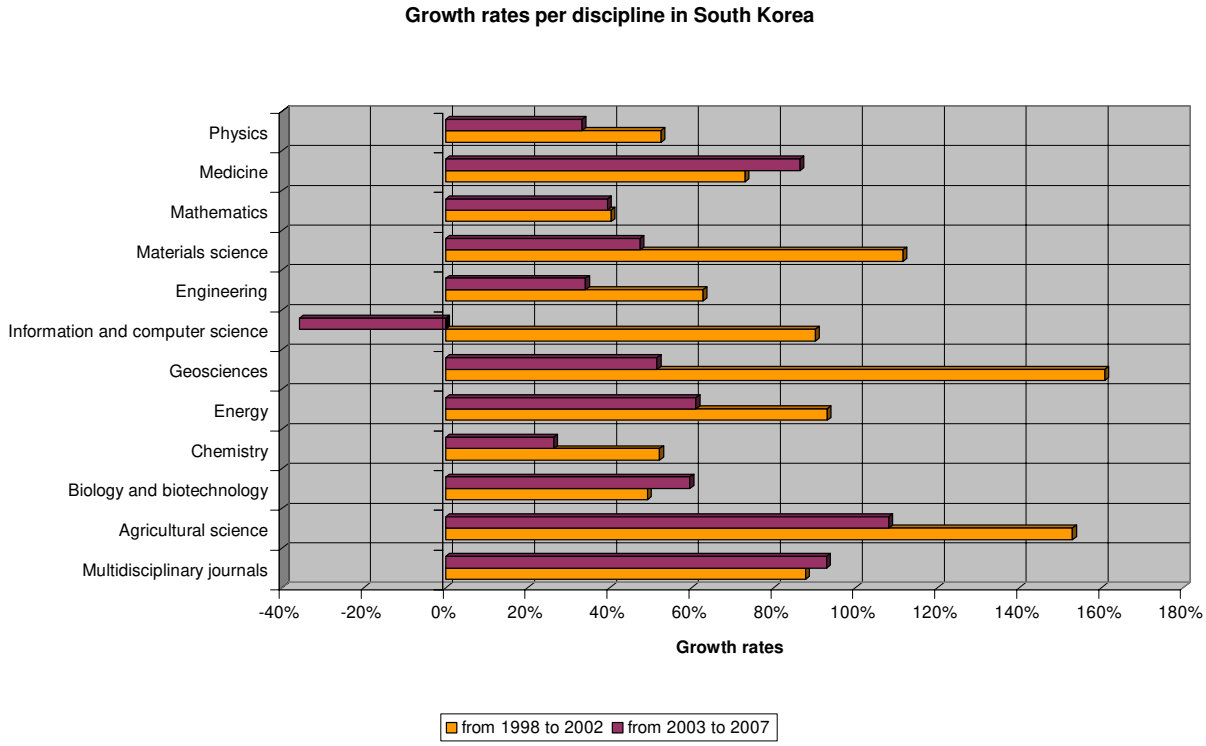

Figure 50: Growth rates of the output in individual disciplines (South Korea)

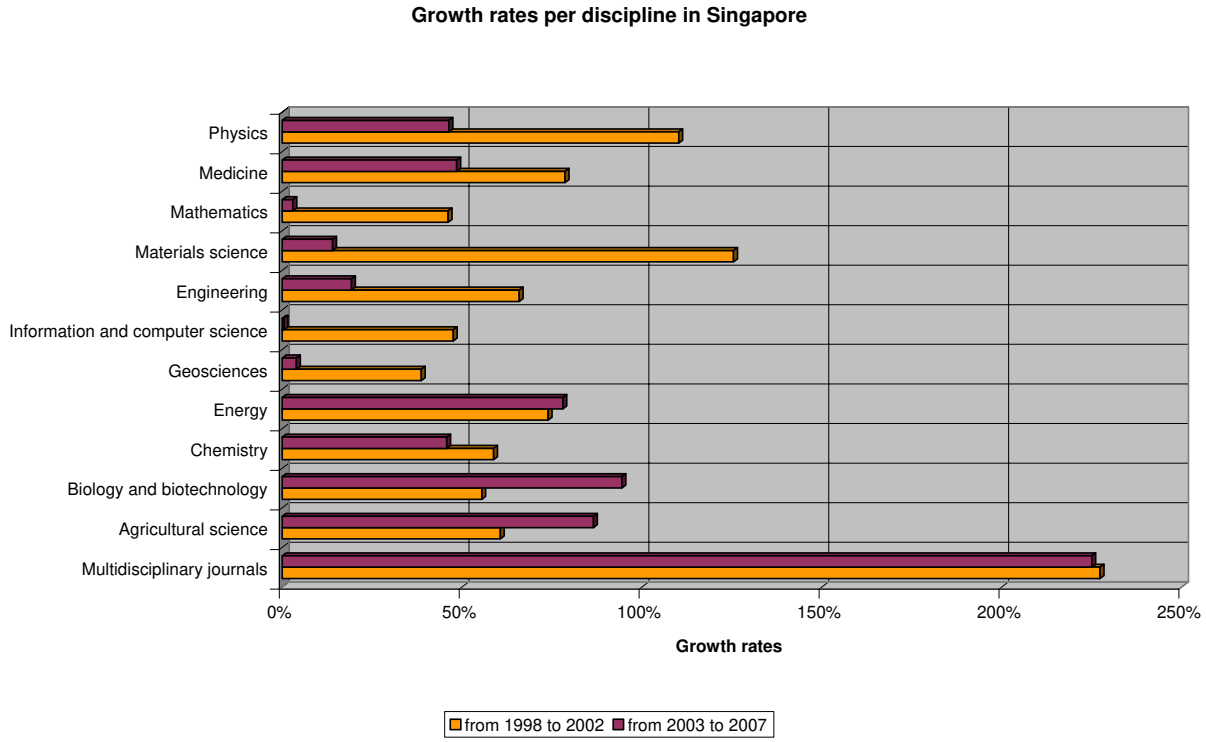

Figure 51: Growth rates of the output in individual disciplines (Singapore)

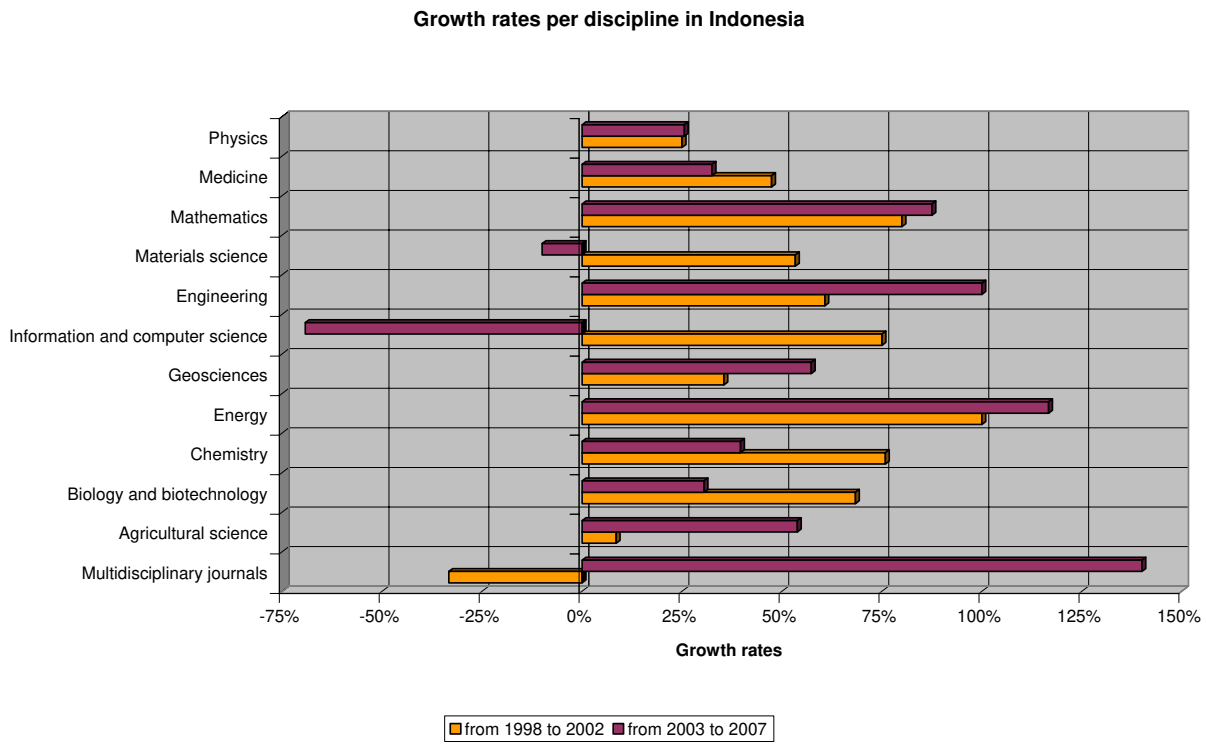

Figure 52: Growth rates of the output in individual disciplines (Indonesia)

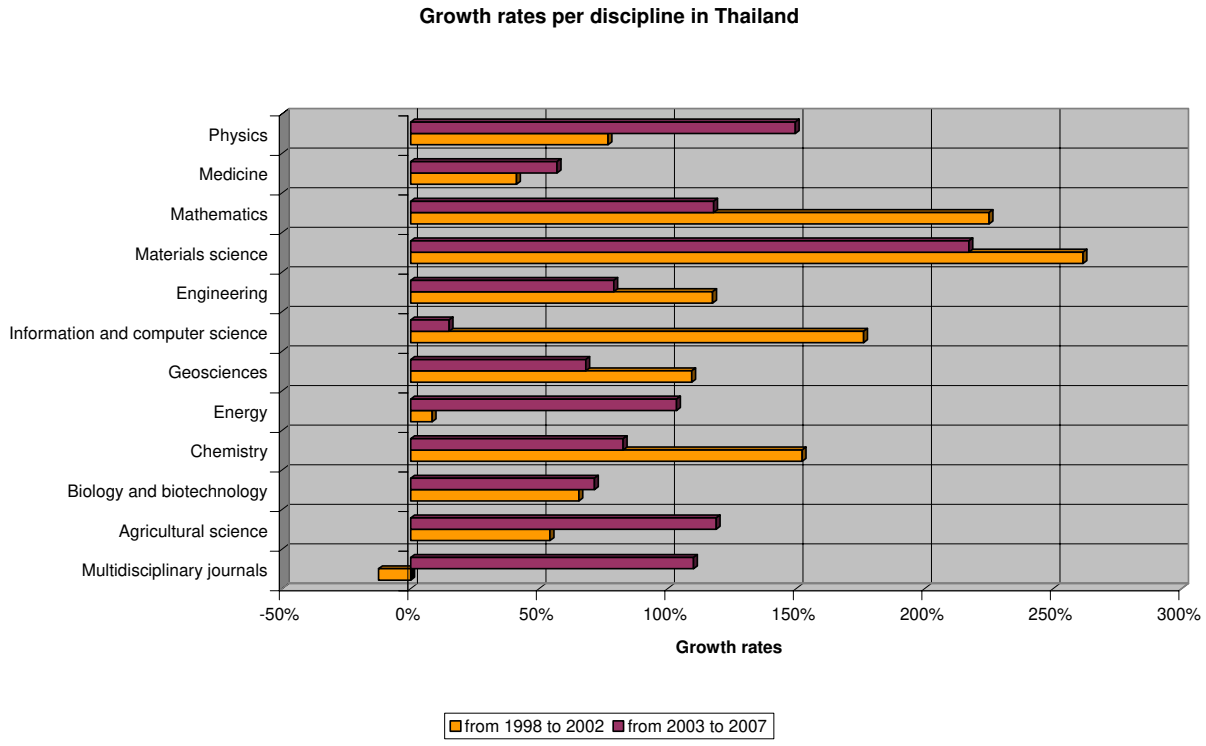

Figure 53: Growth rates of the output in individual disciplines (Thailand)

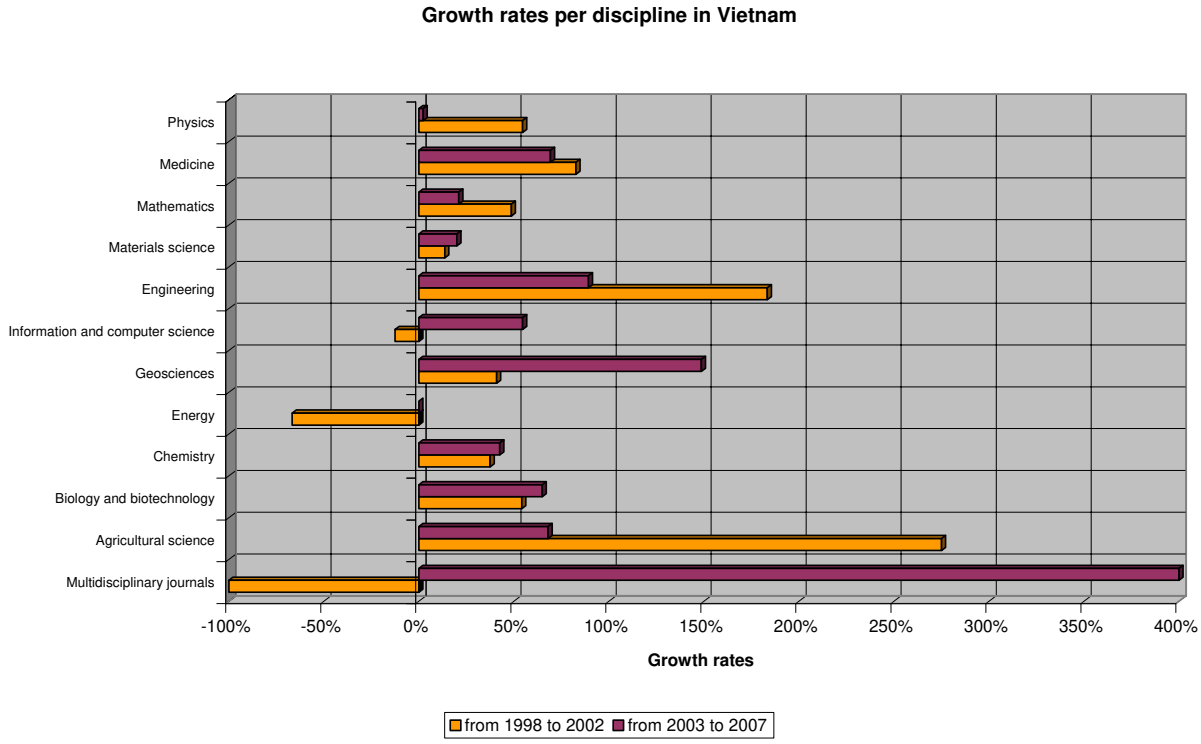

Figure 54: Growth rates of the output in individual disciplines (Vietnam)

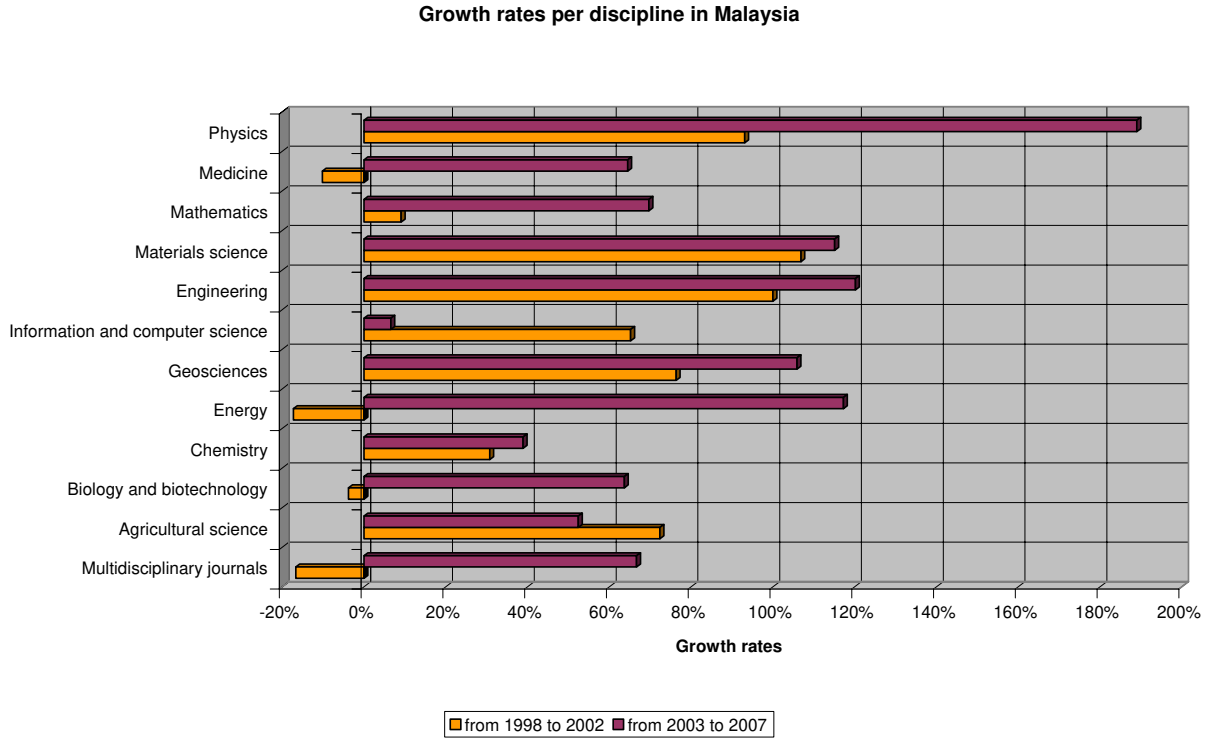

Figure 55: Growth rates of the output in individual disciplines (Malaysia)

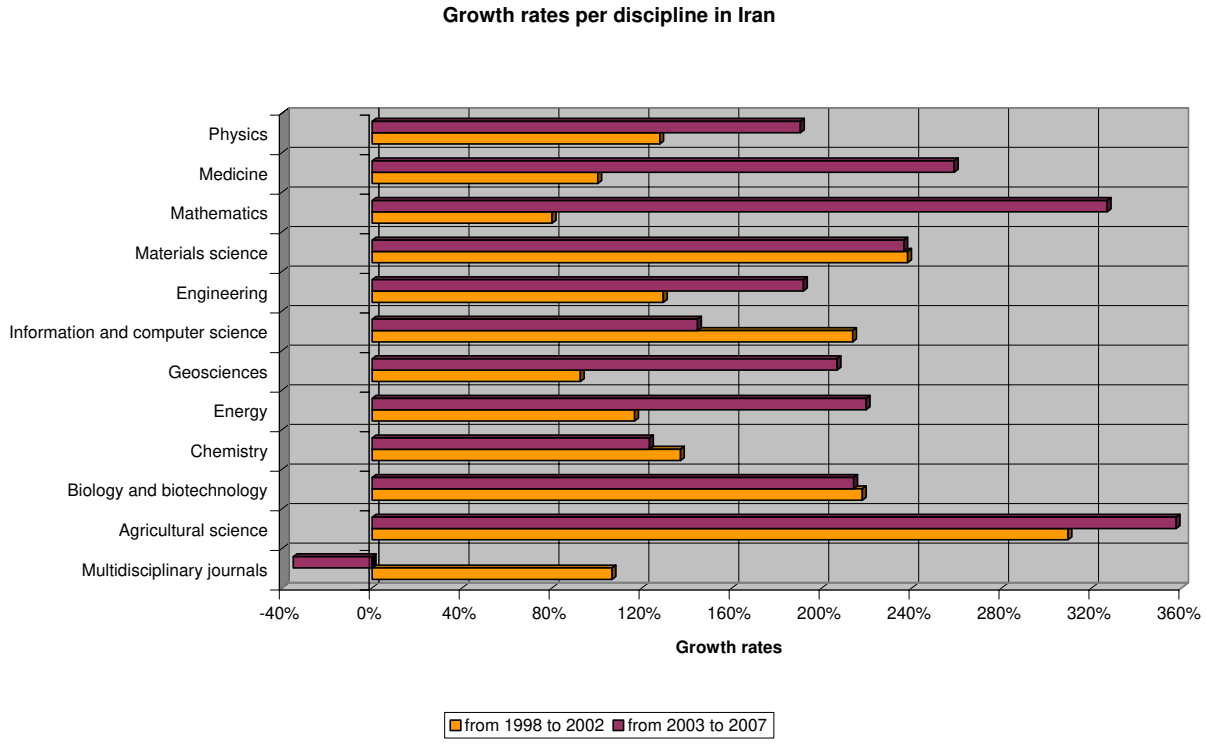

Figure 56: Growth rates of the output in individual disciplines (Iran)

Table 7: Growth rates of the output in individual disciplines

Growth rates Germany		
Discipline	**from 1998 to 2002**	**from 2003 to 2007**
Multidisciplinary journals	8.45%	17.88%
Agricultural science	3.39%	33.56%
Biology and biotechnology	4.42%	27.10%
Chemistry	-4.21%	5.22%
Energy	0.23%	1.41%
Geosciences	33.25%	40.46%
Information and computer science	20.08%	-39.74%
Engineering	1.88%	6.35%
Materials science	-1.29%	23.37%
Mathematics	-1.48%	9.67%
Medicine	8.10%	32.30%
Physics	5.68%	4.04%

Growth rates China		
Discipline	**from 1998 to 2002**	**from 2003 to 2007**
Multidisciplinary journals	-3.52%	48.94%
Agricultural science	126.00%	269.75%
Biology and biotechnology	101.31%	119.94%
Chemistry	107.33%	80.48%
Energy	51.14%	157.89%
Geosciences	138.86%	103.13%
Information and computer science	210.58%	55.88%
Engineering	124.18%	97.56%
Materials science	104.31%	115.41%
Mathematics	69.66%	83.79%
Medicine	130.79%	86.37%
Physics	77.57%	89.48%

Growth rates Japan		
Discipline	**from 1998 to 2002**	**from 2003 to 2007**
Multidisciplinary journals	-1.00%	9.35%
Agricultural science	8.27%	11.80%
Biology and biotechnology	14.22%	5.82%
Chemistry	1.82%	-7.54%
Energy	-2.16%	-6.52%
Geosciences	37.36%	3.96%
Information and computer science	14.43%	-33.97%
Engineering	3.84%	-2.40%
Materials science	18.79%	1.80%
Mathematics	17.44%	1.93%
Medicine	6.71%	3.38%
Physics	13.29%	-6.25%

Growth rates New Zealand		
Discipline	**from 1998 to 2002**	**from 2003 to 2007**
Multidisciplinary journals	11.29%	-2.74%
Agricultural science	0.19%	21.56%
Biology and biotechnology	7.80%	33.03%
Chemistry	-18.32%	19.35%
Energy	-34.04%	57.14%
Geosciences	9.98%	23.30%
Information and computer science	75.53%	-20.18%
Engineering	11.41%	34.34%
Materials science	3.76%	98.18%
Mathematics	21.09%	18.71%
Medicine	2.76%	36.68%
Physics	-2.56%	41.15%

Growth rates Australia		
Discipline	**from 1998 to 2002**	**from 2003 to 2007**
Multidisciplinary journals	-5.90%	36.54%
Agricultural science	18.73%	29.26%
Biology and biotechnology	8.74%	30.48%
Chemistry	0.23%	17.08%
Energy	10.13%	60.37%
Geosciences	14.55%	33.68%
Information and computer science	7.88%	-19.09%
Engineering	8.60%	30.95%
Materials science	0.70%	42.36%
Mathematics	-4.56%	18.79%
Medicine	14.88%	38.30%
Physics	-1.49%	24.47%

Growth rates Taiwan		
Discipline	**from 1998 to 2002**	**from 2003 to 2007**
Multidisciplinary journals	19.51%	105.56%
Agricultural science	73.13%	84.47%
Biology and biotechnology	28.10%	51.93%
Chemistry	34.51%	38.19%
Energy	51.22%	129.08%
Geosciences	42.29%	50.37%
Information and computer science	36.13%	37.25%
Engineering	18.60%	58.63%
Materials science	66.12%	60.91%
Mathematics	22.41%	68.23%
Medicine	35.31%	47.72%
Physics	32.21%	67.27%

Growth rates South Korea		
Discipline	**from 1998 to 2002**	**from 2003 to 2007**
Multidisciplinary journals	87.80%	92.86%
Agricultural science	152.94%	108.12%
Biology and biotechnology	49.26%	59.51%
Chemistry	52.16%	26.32%
Energy	93.01%	61.04%
Geosciences	160.88%	51.56%
Information and computer science	90.14%	-35.73%
Engineering	62.75%	34.07%
Materials science	111.62%	47.45%
Mathematics	40.30%	39.38%
Medicine	72.98%	86.45%
Physics	52.54%	33.22%

Growth rates Singapore		
Discipline	**from 1998 to 2002**	**from 2003 to 2007**
Multidisciplinary journals	227.27%	225.00%
Agricultural science	60.61%	86.49%
Biology and biotechnology	55.48%	94.41%
Chemistry	58.74%	45.74%
Energy	73.91%	78.00%
Geosciences	38.65%	3.96%
Information and computer science	47.56%	0.54%
Engineering	65.86%	19.26%
Materials science	125.42%	14.01%
Mathematics	46.11%	2.95%
Medicine	78.60%	48.50%
Physics	110.22%	46.33%

Growth rates Indonesia		
Discipline	**from 1998 to 2002**	**from 2003 to 2007**
Multidisciplinary journals	-33.33%	140.00%
Agricultural science	8.54%	53.85%
Biology and biotechnology	68.37%	30.52%
Chemistry	75.86%	39.62%
Energy	100.00%	116.67%
Geosciences	35.48%	57.33%
Information and computer science	75.00%	-69.23%
Engineering	60.71%	100.00%
Materials science	53.33%	-10.00%
Mathematics	80.00%	87.50%
Medicine	47.41%	32.50%
Physics	25.00%	25.58%

Growth rates Thailand		
Discipline	**from 1998 to 2002**	**from 2003 to 2007**
Multidisciplinary journals	-12.50%	110.00%
Agricultural science	54.21%	118.84%
Biology and biotechnology	65.45%	71.48%
Chemistry	152.29%	82.64%
Energy	8.33%	103.39%
Geosciences	109.33%	68.13%
Information and computer science	176.19%	14.94%
Engineering	117.43%	79.00%
Materials science	261.54%	217.14%
Mathematics	225.00%	117.86%
Medicine	41.17%	56.92%
Physics	76.79%	149.61%

Growth rates Vietnam		
Discipline	**from 1998 to 2002**	**from 2003 to 2007**
Multidisciplinary journals	-100.00%	400.00%
Agricultural science	275.00%	68.00%
Biology and biotechnology	54.17%	64.89%
Chemistry	37.50%	42.55%
Energy	-66.67%	0.00%
Geosciences	40.91%	148.65%
Information and computer science	-12.50%	54.55%
Engineering	183.33%	89.29%
Materials science	13.64%	20.00%
Mathematics	48.65%	20.97%
Medicine	82.67%	69.23%
Physics	54.55%	2.27%

Growth rates Malaysia		
Discipline	**from 1998 to 2002**	**from 2003 to 2007**
Multidisciplinary journals	-16.67%	66.67%
Agricultural science	72.37%	52.42%
Biology and biotechnology	-3.77%	63.68%
Chemistry	30.77%	38.91%
Energy	-17.24%	117.24%
Geosciences	76.36%	105.88%
Information and computer science	65.22%	6.58%
Engineering	100.00%	120.19%
Materials science	106.86%	115.13%
Mathematics	9.09%	69.70%
Medicine	-10.20%	64.50%
Physics	93.10%	189.00%

Growth rates Iran		
Discipline	**from 1998 to 2002**	**from 2003 to 2007**
Multidisciplinary journals	106.67%	-35.06%
Agricultural science	309.38%	357.46%
Biology and biotechnology	217.95%	214.10%
Chemistry	137.08%	123.30%
Energy	116.67%	219.67%
Geosciences	92.59%	206.71%
Information and computer science	213.64%	144.64%
Engineering	129.45%	191.75%
Materials science	238.10%	236.41%
Mathematics	80.00%	326.80%
Medicine	100.32%	258.82%
Physics	127.89%	190.41%

2.3 Co-Publications

The number of co-publications provides information on the main emphasis of joint scientific publications in the individual disciplines. The section that follows presents rankings for each of the countries studied within the framework of this analysis and shows which countries tend to work together in the various disciplines. Not only will cooperations between the countries of this analysis be investigated, but co-publications with other countries throughout the world will also be taken into account. For Indonesia, Malaysia, Singapore, Thailand and Vietnam co-publications with the EU-27 are shown separately. Due to co-publications within the EU, publications of the 27 EU member states cannot be added up. This ranking will be performed for two periods, each five years in length, as well as for the period as a whole. This allows us to detect changes in co-publication practice. As was the case for co-publications according to country, no direct comparison is possible here between the individual disciplines due to the fact that each discipline has different communication habits.

Ranking of selected key countries including EU-27 comparison

Indonesia

Agricultural Science

1998-2007			***1998-2002***			***2003-2007***		
#	*Country*	*Co-Publications*	*#*	*Country*	*Co-Publications*	*#*	*Country*	*Co-Publications*
-	EU-27	226	-	EU-27	118	-	EU-27	108
1	Japan	168	*1*	USA	84	*1*	Japan	104
2	USA	152	*2*	Japan	64	*2*	USA	68
3	Australia	101	*3*	Australia	41	*3*	Australia	60
4	Netherlands	67	*4*	Netherlands	35	*4*	Germany	36
5	Germany	65	*5*	UK	34	*5*	Netherlands	32
6	UK	46	*6*	Germany	29	*6*	Thailand	18
7	France	28	*7*	Vietnam	12	*7*	France	17
8	Philippines	26	*8*	France	11	*7*	Philippines	17
9	Vietnam	25	*9*	Malaysia	10	*9*	Malaysia	13
10	Thailand	24	*10*	Philippines	9	*9*	Vietnam	13

Biology and Biotechnology

1998-2007			***1998-2002***			***2003-2007***		
#	*Country*	*Co-Publications*	*#*	*Country*	*Co-Publications*	*#*	*Country*	*Co-Publications*
-	EU-27	531	-	EU-27	206	-	EU-27	325
1	USA	342	*1*	USA	136	*1*	Japan	208
2	Japan	326	*2*	Australia	125	*2*	USA	206
3	Australia	264	*3*	Japan	118	*3*	Australia	139
4	Netherlands	148	*4*	UK	58	*4*	Netherlands	95
5	UK	147	*5*	Netherlands	53	*5*	Germany	94
6	Germany	140	*6*	Germany	46	*6*	UK	89
7	France	86	*7*	France	41	*7*	France	45
8	Thailand	59	*8*	Canada	23	*8*	Thailand	39
9	Malaysia	55	*9*	Malaysia	22	*9*	Malaysia	33
10	Canada	52	*10*	Thailand	20	*10*	Canada	29

Chemistry 1998-2007			1998-2002			2003-2007		
#	Country	Co-Publications	#	Country	Co-Publications	#	Country	Co-Publications
1	Japan	197	1	Japan	71	1	Japan	126
-	EU-27	155	-	EU-27	67	-	EU-27	88
2	Australia	117	2	Australia	44	2	Australia	73
3	USA	45	3	Germany	18	3	USA	27
4	Italy	38	4	USA	18	4	Italy	26
5	Germany	36	5	France	15	5	Netherlands	25
6	Netherlands	34	6	Italy	12	6	Malaysia	20
7	Malaysia	25	7	Netherlands	9	7	Germany	18
8	France	22	7	New Zealand	9	8	Canada	10
9	Canada	18	9	Canada	8	9	South Korea	8
10	New Zealand	16	10	Austria	6	9	China	8

Energy 1998-2007			1998-2002			2003-2007		
#	Country	Co-Publications	#	Country	Co-Publications	#	Country	Co-Publications
-	EU-27	29	-	EU-27	24	1	Japan	15
1	Japan	24	1	Japan	9	2	Malaysia	8
2	USA	13	1	USA	9	-	EU-27	5
3	Australia	9	3	Australia	7	3	USA	4
3	Malaysia	9	3	UK	7	4	Thailand	3
5	UK	8	5	France	4	4	Philippines	3
6	France	5	6	Canada	3	6	Australia	2
7	Germany	4	6	Italy	3	6	Germany	2
7	Thailand	4	8	Poland	2	6	South Korea	2
9	Bangladesh	3	8	Belgium	2	6	China	2
9	Canada	3	8	Bangladesh	2	6	Vietnam	2
9	Italy	3	8	Hungary	2	6	Singapore	2
9	Philippines	3	8	Bulgaria	2			
			8	Libya	2			
			8	Sudan	2			
			8	Germany	2			

Geoscience 1998-2007			1998-2002			2003-2007		
#	Country	Co-Publications	#	Country	Co-Publications	#	Country	Co-Publications
-	EU-27	319	-	EU-27	148	-	EU-27	171
1	Japan	220	1	USA	95	1	Japan	141
2	USA	212	2	Japan	79	2	USA	117
3	Australia	136	3	Australia	69	3	Australia	67
4	France	89	4	France	54	4	Germany	53
5	UK	81	5	UK	41	5	UK	40
6	Germany	71	6	Canada	27	6	Netherlands	37
7	Netherlands	63	7	Netherlands	26	7	France	35
8	Canada	44	8	Germany	18	8	Thailand	22
9	Philippines	28	9	Philippines	10	9	Philippines	18
10	Thailand	24	9	Belgium	10	10	Canada	17

Information Science and Computer Science 1998-2007			1998-2002			2003-2007		
#	Country	Co-Publications	#	Country	Co-Publications	#	Country	Co-Publications
1	Japan	27	1	Japan	9	1	Japan	18
2	Australia	14	-	EU-27	7	2	Australia	7
-	EU-27	12	2	Australia	7	-	EU-27	5
3	Netherlands	7	3	Netherlands	3	3	USA	4
4	USA	4	4	Germany	2	4	Netherlands	4
5	France	2	4	France	2	5	Singapore	2
5	Germany	2				5	Malaysia	2
5	Malaysia	2						
5	Singapore	2						

Engineering Science 1998-2007			1998-2002			2003-2007		
#	Country	Co-Publications	#	Country	Co-Publications	#	Country	Co-Publications
1	Japan	131	1	Japan	57	1	Japan	74
-	EU-27	108	-	EU-27	44	-	EU-27	64
2	USA	58	2	USA	33	2	Australia	26
3	Australia	56	3	Australia	30	3	USA	25
4	UK	34	4	UK	15	4	UK	19
5	Canada	27	5	France	12	5	Malaysia	18
6	Netherlands	23	6	Canada	10	6	Canada	17
7	Malaysia	21	7	Netherlands	6	6	Netherlands	17
8	France	18	7	Germany	6	8	Germany	10
9	Germany	16	9	Singapore	4	9	Singapore	9
10	Singapore	13	10	Malaysia	3	10	Sweden	7
			10	Belgium	3			

Materials Science

1998-2007			1998-2002			2003-2007		
#	Country	Co-Publications	#	Country	Co-Publications	#	Country	Co-Publications
1	Japan	104	1	Japan	39	1	Japan	65
-	EU-27	67	-	EU-27	26	-	EU-27	41
2	Australia	31	2	Australia	14	2	Malaysia	17
3	Germany	22	3	France	12	2	Germany	17
3	Malaysia	22	4	UK	7	2	Australia	17
5	France	17	5	USA	6	5	UK	6
6	UK	13	6	Canada	5	6	Netherlands	5
7	Canada	10	6	Malaysia	5	6	Canada	5
7	USA	10	6	Germany	5	6	France	5
9	Netherlands	7	9	Thailand	2	9	USA	4
10	Austria	4	9	Netherlands	2	9	South Korea	4
10	South Korea	4	9	Czech Republic	2			

Mathematics

1998-2007			1998-2002			2003-2007		
#	Country	Co-Publications	#	Country	Co-Publications	#	Country	Co-Publications
-	EU-27	32	-	EU-27	9	-	EU-27	23
1	Australia	17	1	Australia	8	1	Australia	9
2	Netherlands	12	2	USA	4	2	Netherlands	8
3	USA	7	2	Netherlands	4	3	Japan	4
4	Canada	5	4	Slovakia	2	3	Canada	4
5	Japan	5				5	USA	3
6	Slovakia	5				5	UK	3
7	UK	4				5	Romania	3
8	France	3				5	Germany	3
9	Germany	3				5	Slovakia	3
10	Romania	3				10	Pakistan	2
						10	France	2

Medicine

1998-2007			1998-2002			2003-2007		
#	Country	Co-Publications	#	Country	Co-Publications	#	Country	Co-Publications
-	EU-27	534	-	EU-27	225	-	EU-27	309
1	USA	402	1	USA	157	1	Japan	257
2	Japan	363	2	Japan	106	2	USA	245
3	Australia	228	3	Australia	103	3	Thailand	143
4	Netherlands	218	4	Netherlands	84	4	Netherlands	134
5	Thailand	191	5	Germany	56	5	Australia	125
6	South Korea	127	6	UK	50	6	South Korea	119
7	UK	115	7	Thailand	48	7	China	71
8	Germany	104	8	Malaysia	27	8	UK	65
9	China	95	9	China	24	9	Malaysia	52
10	Malaysia	79	10	Singapore	23	10	Germany	48

Central Library

Multidisciplinary Journals								
1998-2007			1998-2002			2003-2007		
#	Country	Co-Publications	#	Country	Co-Publications	#	Country	Co-Publications
1	USA	38	1	USA	10	1	USA	28
-	EU-27	26	-	EU-27	8	-	EU-27	18
2	Australia	18	2	Germany	5	2	Australia	16
3	Japan	13	3	UK	3	3	Japan	10
4	UK	10	3	Japan	3	4	India	9
5	Germany	9	3	France	3	5	Netherlands	8
5	India	9	6	Australia	2	5	China	8
5	China	9				6	UK	7
8	France	8				7	Vietnam	6
8	Netherlands	8				7	Malaysia	6
10	Malaysia	6				10	France	5
10	Vietnam	6						

Physics								
1998-2007			1998-2002			2003-2007		
#	Country	Co-Publications	#	Country	Co-Publications	#	Country	Co-Publications
-	EU-27	158	-	EU-27	72	-	EU-27	86
1	Japan	123	1	Japan	40	1	Japan	83
2	Netherlands	61	2	Netherlands	28	2	Netherlands	33
3	USA	57	3	USA	28	3	USA	29
4	Germany	50	4	Germany	22	4	Germany	28
5	Australia	35	5	Australia	20	5	Australia	15
6	France	27	6	Canada	17	6	South Korea	14
7	Canada	24	7	France	14	7	France	13
8	South Korea	16	8	Austria	7	8	Canada	7
9	Austria	13	9	Poland	6	9	Malaysia	6
10	UK	10	10	UK	4	9	UK	6
			10	Belgium	4	9	Austria	6
			10	China	4	9	Italy	6

Malaysia

Agricultural Science								
1998-2007			1998-2002			2003-2007		
#	Country	Co-Publications	#	Country	Co-Publications	#	Country	Co-Publications
-	EU-27	129	-	EU-27	45	-	EU-27	84
1	Japan	84	1	UK	31	1	Japan	63
2	UK	75	2	USA	25	2	UK	44
3	USA	62	3	Japan	21	3	USA	37
4	Australia	40	4	Bangladesh	18	4	Australia	27
5	Canada	29	4	Canada	15	5	Canada	14
6	Bangladesh	27	6	Kenya	14	5	India	14
7	Indonesia	23	7	Australia	13	5	Thailand	14
8	India	18	8	Indonesia	10	5	Iran	14
9	Kenya	17	9	Philippines	5	9	Indonesia	13
9	Thailand	17	9	Belgium	5	10	Netherlands	12

Biology and Biotechnology

1998-2007			1998-2002			2003-2007		
#	Country	Co-Publications	#	Country	Co-Publications	#	Country	Co-Publications
-	EU-27	478	-	EU-27	193	-	EU-27	285
1	Japan	260	1	UK	118	1	Japan	158
2	UK	256	2	Japan	102	2	USA	144
3	USA	235	3	USA	91	3	UK	138
4	Australia	124	4	Australia	45	4	Australia	79
5	Singapore	107	5	Singapore	33	5	Singapore	74
6	Germany	71	6	France	27	6	Germany	55
7	France	67	7	Indonesia	22	7	France	40
8	Indonesia	55	8	Thailand	21	8	India	38
9	Thailand	54	9	Canada	17	9	Thailand	33
10	India	48	10	Germany	16	9	Indonesia	33

Chemistry

1998-2007			1998-2002			2003-2007		
#	Country	Co-Publications	#	Country	Co-Publications	#	Country	Co-Publications
1	China	244	1	China	136	-	EU-27	149
-	EU-27	284	-	EU-27	135	1	China	108
2	Japan	146	2	UK	73	2	Japan	100
3	UK	139	3	Japan	46	3	UK	66
4	India	85	4	Australia	30	4	India	62
5	Australia	63	5	Singapore	27	5	Germany	39
5	Germany	63	6	Germany	24	6	USA	35
7	USA	57	7	India	23	7	Australia	33
8	Singapore	41	7	Thailand	23	8	Iran	24
9	Thailand	38	9	USA	22	9	Indonesia	20
10	Iran	29	10	Canada	17	10	Pakistan	17

Energy

1998-2007			1998-2002			2003-2007		
#	Country	Co-Publications	#	Country	Co-Publications	#	Country	Co-Publications
-	EU-27	43	-	EU-27	30	-	EU-27	13
1	UK	26	1	UK	19	1	USA	10
2	USA	19	2	USA	9	2	Indonesia	8
3	India	11	3	India	6	3	Singapore	7
4	Indonesia	9	4	Bangladesh	5	3	UK	7
5	Bangladesh	8	5	Germany	4	5	India	5
6	Singapore	7	5	Canada	4	6	China	4
7	Canada	6	7	Romania	3	7	Iran	3
8	Germany	5	7	Jordan	3	7	Japan	3
8	Japan	5	9	Libya	2	7	Iraq	3
8	Libya	5	9	Turkey	2	7	Bangladesh	3
			9	Nepal	2	7	Libya	3
			9	Sweden	2			
			9	Kuwait	2			
			9	Japan	2			
			9	Australia	2			
			9	New Zealand	2			

Geoscience								
1998-2007			1998-2002			2003-2007		
#	Country	Co-Publications	#	Country	Co-Publications	#	Country	Co-Publications
-	EU-27	181	-	EU-27	67	-	EU-27	114
1	UK	107	1	UK	41	1	Japan	66
2	Japan	93	2	USA	30	1	UK	66
3	USA	89	3	Japan	27	3	USA	59
4	Australia	61	4	Australia	23	4	Australia	38
5	Singapore	27	5	Bangladesh	9	5	Singapore	22
6	Canada	25	5	Belgium	9	6	India	17
7	Bangladesh	24	7	Canada	8	6	Thailand	17
8	China	23	7	China	8	6	Canada	17
9	Indonesia	21	9	Indonesia	7	9	China	15
9	Thailand	21	10	Singapore	5	9	Bangladesh	15

Information Science and Computer Science								
1998-2007			1998-2002			2003-2007		
#	Country	Co-Publications	#	Country	Co-Publications	#	Country	Co-Publications
-	EU-27	85	-	EU-27	27	-	EU-27	58
1	UK	60	1	UK	23	1	UK	37
2	Japan	33	2	Japan	8	2	Japan	25
3	Australia	25	3	India	7	3	Australia	20
4	USA	24	3	USA	7	4	USA	17
5	India	23	5	Australia	5	5	India	16
6	Singapore	15	6	Ireland	3	6	Singapore	13
7	Canada	11	6	Canada	3	7	Canada	8
8	New Zealand	8	8	U Arab Emirates	2	8	New Zealand	7
9	China	7	8	Singapore	2	9	South Korea	6
10	South Korea	6				9	China	6

Engineering Science								
1998-2007			1998-2002			2003-2007		
#	Country	Co-Publications	#	Country	Co-Publications	#	Country	Co-Publications
-	EU-27	336	-	EU-27	128	-	EU-27	208
1	UK	250	1	UK	106	1	UK	144
2	India	132	2	USA	33	2	India	103
3	USA	101	3	India	29	3	USA	68
4	Japan	78	4	Japan	24	4	Japan	54
5	Singapore	70	5	Australia	22	5	Singapore	50
6	Australia	51	6	Singapore	20	6	Australia	29
7	Bangladesh	27	7	Ireland	14	7	Romania	21
8	China	23	8	Bangladesh	10	8	China	19
9	Canada	21	9	Canada	9	9	Germany	18
9	Indonesia	21	10	Turkey	4	9	Indonesia	18
9	Romania	21	10	China	4			
			10	U Arab Emirates	4			

Materials Science 1998-2007			1998-2002			2003-2007		
#	Country	Co-Publications	#	Country	Co-Publications	#	Country	Co-Publications
1	China	738	1	China	166	1	China	572
2	India	343	2	India	137	2	India	206
3	Thailand	222	3	Thailand	90	3	Thailand	132
-	EU-27	185	-	EU-27	85	-	EU-27	100
4	UK	123	4	UK	59	4	UK	64
5	Japan	76	5	Japan	28	5	Japan	48
6	USA	69	6	USA	25	6	USA	44
7	Turkey	39	7	Turkey	20	7	Pakistan	33
8	Pakistan	35	8	Australia	19	8	Iran	26
9	Australia	34	9	Germany	12	9	Turkey	19
9	Iran	34	10	Iran	8	10	Indonesia	17
			10	Macedonia	8	10	Germany	17

Mathematics 1998-2007			1998-2002			2003-2007		
#	Country	Co-Publications	#	Country	Co-Publications	#	Country	Co-Publications
-	EU-27	49	-	EU-27	24	-	EU-27	25
1	UK	37	1	UK	24	1	UK	13
2	India	22	2	India	10	2	India	12
3	USA	18	3	Australia	8	3	USA	10
4	Australia	17	4	USA	8	4	Australia	9
5	Singapore	10	5	Singapore	6	5	Romania	5
6	Canada	9	6	Canada	5	6	China	4
7	China	5	7			6	Singapore	4
7	Romania	5	8			6	Canada	4
9	Iran	4	9			9	Uzbekistan	3
10	Japan	3	10			9	Iran	3
10	South Korea	3						
10	Uzbekistan	3						

Medicine 1998-2007			1998-2002			2003-2007		
#	Country	Co-Publications	#	Country	Co-Publications	#	Country	Co-Publications
-	EU-27	505	-	EU-27	184	-	EU-27	321
1	USA	333	1	UK	115	1	USA	225
2	UK	292	2	USA	108	2	Australia	185
3	Australia	263	3	Australia	78	3	UK	177
4	Japan	201	4	Japan	68	4	Singapore	151
5	Singapore	200	5	Singapore	49	5	Japan	133
6	China	122	6	China	28	6	China	94
7	Thailand	113	7	Indonesia	27	7	Thailand	87
8	India	94	8	Thailand	26	8	India	70
9	Taiwan	80	8	Canada	26	9	Taiwan	62
10	Indonesia	79	10	India	24	10	South Korea	58

Multidisciplinary Journals								
1998-2007			1998-2002			2003-2007		
#	Country	Co-Publications	#	Country	Co-Publications	#	Country	Co-Publications
-	EU-27	21	-	EU-27	7	-	EU-27	14
1	USA	17	1	USA	7	1	USA	10
2	India	11	2	Singapore	4	2	India	8
3	Japan	10	3	India	3	2	Japan	8
4	UK	9	3	UK	3	4	Australia	6
5	Australia	8	5	Thailand	2	4	Indonesia	6
6	Germany	7	5	Kenya	2	4	UK	6
6	Singapore	7	5	Germany	2	7	Thailand	5
6	Thailand	7	5	Japan	2	7	Germany	5
9	Indonesia	6	5	Australia	2	9	Canada	4
10	Canada	4				9	Italy	4
10	Italy	4						

Nanotechnology								
1998-2007			1998-2002			2003-2007		
#	Country	Co-Publications	#	Country	Co-Publications	#	Country	Co-Publications
-	EU-27	9		none		-	EU-27	9
1	Japan	7				1	Japan	7
2	USA	4				2	USA	4
2	UK	4				2	UK	4
4	Germany	3				4	Germany	3
5	Sweden	2				5	Sweden	2
5	Singapore	2				5	Singapore	2
5	China	2				5	China	2

Physik								
1998-2007			1998-2002			2003-2007		
#	Land	Kopublikationen	#	Land	Kopublikationen	#	Land	Kopublikationen
-	EU-27	203	-	EU-27	74	-	EU-27	129
1	UK	109	1	UK	47	1	UK	62
2	USA	71	2	Japan	20	2	USA	54
3	Japan	68	3	USA	17	3	Japan	48
4	India	63	3	India	17	4	India	46
5	Romania	42	5	Australia	11	5	Romania	40
6	Singapore	38	6	China	10	6	Singapore	33
7	Germany	37	7	Germany	8	7	Germany	29
8	Australia	29	8	Poland	7	8	South Korea	27
9	Poland	28	9	Singapore	5	9	Canada	25
10	South Korea	27	10	Czech Republic	4	10	Italy	23
			10	Jordan	4			

Singapore

Agricultural Science								
1998-2007			***1998-2002***			***2003-2007***		
#	*Country*	*Co-Publications*	*#*	*Country*	*Co-Publications*	*#*	*Country*	*Co-Publications*
-	EU-27	74	-	EU-27	39	*1*	USA	50
1	USA	66	*1*	UK	16	-	EU-27	35
2	China	39	*1*	USA	16	*2*	Australia	29
3	Australia	38	*3*	Netherlands	14	*2*	China	29
4	UK	25	*4*	Japan	12	*4*	New Zealand	20
5	New Zealand	24	*5*	China	10	*5*	Japan	11
6	Japan	23	*6*	Australia	9	*6*	Oman	10
7	Netherlands	21	*7*	Canada	8	*7*	UK	9
8	Canada	16	*8*	Italy	6	*8*	Canada	8
9	Thailand	12	*9*	New Zealand	4	*8*	Thailand	8
10	Italy	10	*9*	Thailand	4	*10*	Netherlands	7
10	Oman	10						

Biology and Biotechnology								
1998-2007			***1998-2002***			***2003-2007***		
#	*Country*	*Co-Publications*	*#*	*Country*	*Co-Publications*	*#*	*Country*	*Co-Publications*
1	USA	1002	-	EU-27	291	*1*	USA	731
-	EU-27	905	*1*	USA	271	-	EU-27	614
2	China	441	*2*	UK	175	*2*	China	358
3	UK	431	*3*	Australia	92	*3*	UK	256
4	Australia	324	*4*	China	83	*4*	Australia	232
5	Japan	193	*5*	Canada	59	*5*	Japan	136
6	Germany	184	*6*	Japan	57	*6*	Germany	135
7	Canada	165	*7*	Germany	49	*7*	Canada	106
8	France	116	*8*	Switzerland	39	*8*	France	81
9	Malaysia	107	*9*	France	35	*9*	Malaysia	74
10	Switzerland	100	*9*	Taiwan	35	*10*	Taiwan	65
10	Taiwan	100						

Chemistry 1998-2007			1998-2002			2003-2007		
#	Country	Co-Publications	#	Country	Co-Publications	#	Country	Co-Publications
1	China	782	1	China	223	1	China	559
2	USA	585	2	USA	173	2	USA	412
-	EU-27	424	-	EU-27	145	-	EU-27	279
3	Australia	176	3	UK	72	3	Germany	117
4	UK	163	4	Australia	60	4	Australia	116
5	Germany	147	5	Japan	51	5	UK	91
6	Japan	134	6	Canada	39	6	Japan	83
7	Canada	94	7	Germany	30	7	India	57
8	India	83	8	Taiwan	29	8	Canada	55
9	Taiwan	65	9	New Zealand	27	9	Taiwan	36
10	New Zealand	58	9	Malaysia	27	10	New Zealand	31

Energy 1998-2007			1998-2002			2003-2007		
#	Country	Co-Publications	#	Country	Co-Publications	#	Country	Co-Publications
1	China	49	1	China	11	-	EU-27	40
-	EU-27	47	2	USA	10	1	China	38
2	USA	34	-	EU-27	7	2	USA	24
3	UK	17	3	Australia	7	3	UK	15
4	Australia	16	4	Canada	6	4	Australia	9
5	Germany	11	5	Germany	4	5	Finland	8
6	Finland	9	5	South Korea	4	6	Malaysia	7
6	Japan	9	7	Pakistan	3	7	Japan	7
8	Canada	8	8	UK	2	8	Germany	7
9	India	7	8	Japan	2	9	India	6
9	Malaysia	7				10	Russia	6
9	Russia	7						
9	South Korea	7						

Geoscience 1998-2007			1998-2002			2003-2007		
#	Country	Co-Publications	#	Country	Co-Publications	#	Country	Co-Publications
-	EU-27	82	-	EU-27	82	1	USA	148
1	USA	213	1	USA	65	2	China	145
2	China	198	2	UK	55	-	EU-27	132
3	UK	142	3	China	53	3	UK	87
4	Australia	77	4	Australia	27	4	Australia	50
5	Canada	69	5	Canada	23	5	Canada	46
6	Japan	48	6	Japan	16	6	Japan	32
7	Taiwan	43	7	India	15	7	Taiwan	31
8	India	37	8	Taiwan	12	8	Malaysia	22
9	Malaysia	27	9	Germany	10	8	India	22
10	South Korea	23	10	Sweden	9	10	South Korea	18

Information Science and Computer Science								
1998-2007			1998-2002			2003-2007		
#	Country	Co-Publications	#	Country	Co-Publications	#	Country	Co-Publications
1	USA	688	1	USA	216	1	China	521
-	EU-27	422	-	EU-27	121	2	USA	472
2	China	635	2	China	114	-	EU-27	301
3	Australia	240	3	Australia	85	3	Australia	155
4	Canada	126	4	Japan	39	4	UK	93
4	UK	126	5	Canada	38	5	Canada	88
6	India	97	6	UK	33	6	India	68
7	Japan	92	7	India	29	7	Japan	53
8	Germany	72	8	Germany	23	8	Germany	49
9	South Korea	46	9	Hong Kong	18	9	South Korea	41
10	France	43	10	Ireland	15	10	France	38

Engineering Science								
1998-2007			1998-2002			2003-2007		
#	Country	Co-Publications	#	Country	Co-Publications	#	Country	Co-Publications
1	China	1625	1	USA	456	1	China	1203
2	USA	1382	2	China	422	2	USA	926
-	EU-27	969	-	EU-27	332	-	EU-27	637
3	Australia	528	3	Australia	209	3	Australia	319
4	UK	475	4	UK	187	4	UK	288
5	Canada	295	5	Canada	118	5	Canada	177
6	Japan	281	6	Japan	106	6	Japan	175
7	India	243	7	India	86	7	India	157
8	Taiwan	153	8	Germany	47	8	Taiwan	121
9	Germany	140	9	Hong Kong	33	9	Germany	93
10	South Korea	92	10	Taiwan	32	10	South Korea	70

Materials Science								
1998-2007			1998-2002			2003-2007		
#	Country	Co-Publications	#	Country	Co-Publications	#	Country	Co-Publications
1	China	697	1	China	240	1	China	457
2	USA	575	2	USA	181	2	USA	394
-	EU-27	431	-	EU-27	157	-	EU-27	274
3	Australia	254	3	Australia	120	3	Australia	134
4	UK	212	4	UK	81	4	UK	131
5	Japan	153	5	Japan	67	5	Japan	86
6	India	108	6	India	43	6	Germany	66
7	Germany	103	7	Germany	37	7	India	65
8	Canada	59	8	Canada	20	8	Canada	39
9	Taiwan	52	9	Taiwan	14	9	Taiwan	38
10	France	39	10	France	13	10	France	26

Mathematics 1998-2007			1998-2002			2003-2007		
#	Country	Co-Publications	#	Country	Co-Publications	#	Country	Co-Publications
1	USA	508	1	USA	193	1	USA	315
-	EU-27	353	-	EU-27	168	2	China	285
2	China	401	2	China	116	-	EU-27	185
3	Australia	108	3	Ireland	86	3	Australia	65
4	Ireland	105	4	Australia	43	4	UK	61
5	UK	101	5	UK	40	5	Canada	37
6	Canada	68	6	Canada	31	6	Germany	35
7	Japan	48	7	Taiwan	24	7	France	28
8	Germany	45	8	Japan	23	8	Japan	25
9	Taiwan	43	9	India	16	9	New Zealand	21
10	Austria	33	9	Egypt	16	10	Austria	20
10	New Zealand	33						

Medicine 1998-2007			1998-2002			2003-2007		
#	Country	Co-Publications	#	Country	Co-Publications	#	Country	Co-Publications
1	USA	2164	1	USA	605	1	USA	1559
-	EU-27	1693	-	EU-27	493	-	EU-27	1200
2	UK	945	2	UK	335	2	UK	610
3	Australia	749	3	Australia	169	3	China	608
4	China	740	4	China	132	4	Australia	580
5	Canada	354	5	Canada	102	5	Canada	252
6	Germany	293	6	Taiwan	83	6	Germany	241
7	Japan	279	7	Japan	77	7	Japan	202
8	Taiwan	274	8	France	54	8	Taiwan	191
9	France	232	9	Germany	52	9	France	178
10	Malaysia	200	10	Malaysia	49	10	Malaysia	151

Multidisciplinary Journals 1998-2007			1998-2002			2003-2007		
#	Country	Co-Publications	#	Country	Co-Publications	#	Country	Co-Publications
1	USA	54	1	USA	21	1	USA	48
-	EU-27	60	-	EU-27	17	-	EU-27	43
2	China	31	2	UK	14	2	China	33
3	UK	30	3	India	12	3	UK	23
4	India	17	4	China	9	4	Sweden	15
5	Australia	13	5	Australia	6	5	France	12
6	Canada	12	6	Canada	5	5	Australia	12
6	Sweden	12	7	Japan	4	7	Canada	11
8	France	10	7	Germany	4	8	Germany	10
9	Germany	9	7	Malaysia	4	9	Switzerland	8
9	Japan	9	10	Thailand	2	10	Netherlands	7
						10	Japan	7

Nanotechnology

1998-2007			***1998-2002***			***2003-2007***		
#	*Country*	*Co-Publications*	*#*	*Country*	*Co-Publications*	*#*	*Country*	*Co-Publications*
1	USA	145	-	EU-27	26	*1*	USA	125
2	China	118	*1*	China	24	*2*	China	94
-	EU-27	103	*2*	USA	20	-	EU-27	77
3	Germany	32	*3*	Germany	10	*3*	UK	26
4	UK	31	*4*	Australia	6	*4*	Japan	25
5	Japan	29	*5*	UK	5	*5*	Germany	22
6	Australia	25	*6*	Belgium	4	*6*	Australia	19
7	India	15	*6*	Japan	4	*7*	India	13
8	Netherlands	10	*6*	France	4	*8*	Netherlands	7
9	Canada	8	*9*	Netherlands	3	*9*	Switzerland	6
10	Belgium	7	*10*	India	2	*9*	Canada	6
10	France	7	*10*	South Korea	2	*9*	Taiwan	6
10	Switzerland	7	*10*	Spain	2	*9*	Sweden	6
10	Taiwan	7	*10*	New Zealand	2			
			10	Canada	2			

Physics

1998-2007			***1998-2002***			***2003-2007***		
#	*Country*	*Co-Publications*	*#*	*Country*	*Co-Publications*	*#*	*Country*	*Co-Publications*
1	China	1541	*1*	China	464	*1*	China	1077
2	USA	1065	*2*	USA	354	*2*	USA	711
-	EU-27	892	-	EU-27	253	-	EU-27	639
3	UK	390	*3*	Australia	129	*3*	UK	275
4	Australia	339	*4*	UK	115	*4*	Australia	210
5	Japan	270	*5*	Japan	98	*5*	Japan	172
6	Germany	205	*6*	Germany	53	*6*	Germany	152
7	Canada	120	*7*	Canada	41	*7*	Canada	79
8	India	108	*8*	India	33	*8*	India	75
9	Taiwan	89	*9*	Taiwan	25	*9*	Italy	68
10	South Korea	82	*9*	France	25	*10*	Taiwan	64

Thailand

Agricultural Science								
1998-2007			***1998-2002***			***2003-2007***		
#	*Country*	*Co-Publications*	*#*	*Country*	*Co-Publications*	*#*	*Country*	*Co-Publications*
1	Japan	381	*1*	Japan	125	*1*	USA	264
2	USA	358	*-*	EU-27	94	*2*	Japan	256
-	EU-27	282	*2*	USA	94	*-*	EU-27	188
3	Australia	155	*3*	UK	46	*3*	Australia	110
4	UK	99	*4*	Australia	45	*4*	UK	53
5	Germany	53	*5*	Philippines	15	*5*	Germany	42
6	Canada	52	*6*	Canada	11	*6*	Canada	41
7	China	46	*6*	Germany	11	*7*	China	39
8	Philippines	42	*8*	India	9	*8*	Philippines	27
9	India	32	*8*	Israel	9	*9*	India	23
10	Israel	31	*10*	Vietnam	8	*9*	Netherlands	23

Biology and Biotechnology								
1998-2007			***1998-2002***			***2003-2007***		
#	*Country*	*Co-Publications*	*#*	*Country*	*Co-Publications*	*#*	*Country*	*Co-Publications*
-	EU-27	1179	*-*	EU-27	398	*-*	EU-27	781
1	USA	974	*1*	Japan	318	*1*	USA	673
2	Japan	923	*2*	USA	301	*2*	Japan	605
3	UK	502	*3*	UK	167	*3*	UK	335
4	Australia	336	*4*	Australia	107	*4*	Australia	229
5	France	178	*5*	France	58	*5*	China	123
6	Germany	172	*6*	Germany	50	*6*	Germany	122
7	China	167	*7*	China	44	*7*	France	120
8	Canada	108	*8*	Canada	35	*8*	Canada	73
9	Netherlands	99	*8*	Denmark	35	*9*	Sweden	67
10	Sweden	88	*10*	Netherlands	34	*10*	Netherlands	65

Chemistry								
1998-2007			***1998-2002***			***2003-2007***		
#	*Country*	*Co-Publications*	*#*	*Country*	*Co-Publications*	*#*	*Country*	*Co-Publications*
-	EU-27	545	*1*	USA	143	*-*	EU-27	403
1	USA	512	*-*	EU-27	142	*1*	USA	369
2	Japan	499	*2*	Japan	136	*2*	Japan	363
3	UK	191	*3*	UK	54	*3*	UK	137
4	Australia	120	*4*	Australia	27	*4*	Australia	93
5	Germany	92	*5*	Austria	26	*5*	Germany	68
6	Austria	89	*6*	Germany	24	*6*	Austria	63
7	Canada	74	*7*	Malaysia	23	*7*	Canada	54
8	Netherlands	47	*8*	Canada	20	*8*	Netherlands	40
9	France	45	*9*	France	12	*9*	China	35
10	China	42	*10*	Taiwan	8	*10*	France	33

Energy 1998-2007			1998-2002			2003-2007		
#	Country	Co-Publications	#	Country	Co-Publications	#	Country	Co-Publications
-	EU-27	48	-	EU-27	11	-	EU-27	37
1	USA	41	1	USA	10	1	USA	30
2	Japan	38	2	Japan	9	2	Japan	29
3	Australia	16	3	India	5	3	Australia	14
3	Sweden	16	4	Bangladesh	3	3	Sweden	14
5	India	11	5	UK	3	5	France	10
6	France	10	5	Germany	3	6	India	6
7	UK	8	7	Australia	2	6	Sri Lanka	6
8	Germany	7	7	Niederlande	2	8	Canada	5
8	Sri Lanka	7	7	Schweden	2	8	Philippines	5
9	Singapore	6				8	Singapore	5

Geoscience 1998-2007			1998-2002			2003-2007		
#	Country	Co-Publications	#	Country	Co-Publications	#	Country	Co-Publications
1	USA	315	-	EU-27	108	1	USA	240
-	EU-27	295	1	Japan	80	-	EU-27	187
2	Japan	237	2	USA	75	2	Japan	157
3	Australia	138	3	Australia	44	3	Australia	94
4	UK	91	4	UK	31	4	UK	60
5	France	71	5	France	23	5	France	48
6	China	53	6	Germany	22	6	China	44
7	Germany	50	7	Denmark	18	7	Germany	28
8	India	36	8	Canada	13	7	India	28
9	Denmark	35	9	South Korea	10	9	Indonesia	22
10	Canada	33	9	Vietnam	10	9	South Korea	22

Information Science and Computer Science 1998-2007			1998-2002			2003-2007		
#	Country	Co-Publications	#	Country	Co-Publications	#	Country	Co-Publications
1	USA	142		USA	36	1	USA	106
-	EU-27	76	-	EU-27	19	-	EU-27	57
2	Japan	52		Japan	17	2	Japan	35
3	UK	36		UK	7	3	UK	29
4	Australia	19		Australia	6	4	Australia	13
5	Canada	14		Canada	6	5	Austria	8
6	Austria	11		Austria	3	5	Canada	8
7	France	10		France	3	5	China	8
7	China	10		India	2	8	France	7
9	Germany	7		Italy	2	8	Germany	7
9	Vietnam	7		China	2	8	Vietnam	7
				Spain	2			

Engineering Science 1998-2007			1998-2002			2003-2007		
#	Country	Co-Publications	#	Country	Co-Publications	#	Country	Co-Publications
1	USA	560	1	USA	140	1	USA	420
2	Japan	352	2	Japan	121	-	EU-27	233
-	EU-27	317	-	EU-27	84	2	Japan	231
3	UK	153	3	UK	48	3	UK	105
4	Australia	112	4	Australia	30	4	Australia	82
5	Canada	66	5	Canada	25	5	Canada	41
6	China	46	6	India	12	6	France	38
7	France	45	7	China	11	7	China	35
8	South Korea	34	7	South Korea	11	8	Germany	24
9	India	31	9	France	7	9	South Korea	23
10	Germany	29	9	Vietnam	7	10	India	19

Materials Science 1998-2007			1998-2002			2003-2007		
#	Country	Co-Publications	#	Country	Co-Publications	#	Country	Co-Publications
1	Malaysia	222	1	Malaysia	90	1	USA	143
2	USA	180	2	China	49	-	EU-27	135
-	EU-27	166	3	USA	37	2	Malaysia	132
3	Japan	142	-	EU-27	31	3	Japan	112
4	China	80	4	Japan	30	4	UK	67
5	UK	78	5	India	15	5	Australia	31
6	india	43	6	UK	11	5	China	31
7	Australia	41	7	Australia	10	7	India	28
8	Germany	31	8	Germany	6	8	Germany	25
9	France	16	9	Cuba	3	9	France	13
10	Canada	13	9	Finland	3	10	Canada	11
			9	France	3			
			9	South Korea	3			
			9	Spain	3			
			9	Sweden	3			
			9	Taiwan	3			

Mathematics

1998-2007			1998-2002			2003-2007		
#	Country	Co-Publications	#	Country	Co-Publications	#	Country	Co-Publications
1	USA	63	1	USA	14	1	USA	49
-	EU-27	36	-	EU-27	11	-	EU-27	25
2	Australia	15	2	UK	4	2	Australia	14
3	Germany	11	3	Germany	3	3	Germany	8
4	UK	10	4	Japan	2	4	UK	6
5	China	7	4	Netherlands	2	4	China	6
6	Japan	5				6	Vietnam	5
6	Russia	5				7	Russia	4
6	Vietnam	5				7	South Korea	4
9	Philippines	4				7	Spain	4
9	South Korea	4						
9	Spain	4						

Medicine

1998-2007			1998-2002			2003-2007		
#	Country	Co-Publications	#	Country	Co-Publications	#	Country	Co-Publications
1	USA	2476	1	USA	836	1	USA	1636
-	EU-27	1916	-	EU-27	652	-	EU-27	1264
2	Japan	1084	2	Japan	366	2	Japan	717
3	UK	994	3	UK	348	3	UK	646
4	Australia	601	4	Australia	171	4	Australia	430
5	France	305	5	Netherlands	106	5	China	224
6	China	287	6	France	89	6	France	216
7	Netherlands	251	7	Switzerland	85	7	Germany	171
8	Germany	240	8	Germany	69	8	South Korea	168
9	Switzerland	227	9	Canada	68	9	Netherlands	145
10	Canada	212	10	China	62	10	Canada	144

Multidisciplinary Journals

1998-2007			1998-2002			2003-2007		
#	Country	Co-Publications	#	Country	Co-Publications	#	Country	Co-Publications
1	USA	54	1	USA	13	1	USA	41
-	EU-27	53	-	EU-27	12	-	EU-27	41
2	France	25	2	France	7	2	France	18
3	UK	21	3	UK	5	3	UK	16
4	Japan	14	4	Japan	4	4	China	12
5	China	12	5	Myanmar	3	5	Japan	10
6	India	11	6	India	2	6	India	9
7	Australia	8	6	Malaysia	2	7	Australia	7
8	Canada	7	6	Singapore	2	7	Canada	7
8	Germany	7				7	Germany	7
8	Malaysia	7				10	Vietnam	6

Central Library

Nanotechnology

1998-2007			***1998-2002***		***2003-2007***		
#	*Country*	*Co-Publications*	*#*	*Country*	*Co-Publications*	*#*	*Country*	*Co-Publications*
1	USA	19	Due to a low number of publications, the ranking is provided for the entire period under observation only.					
-	EU-27	14						
2	UK	7						
2	Japan	7						
3	Sweden	4						
4	Italy	3						

Physics

1998-2007			***1998-2002***			***2003-2007***		
#	*Country*	*Co-Publications*	*#*	*Country*	*Co-Publications*	*#*	*Country*	*Co-Publications*
-	EU-27	279	*-*	EU-27	73	*-*	EU-27	206
1	USA	243	*1*	USA	59	*1*	USA	184
2	Japan	110	*2*	Japan	31	*2*	Japan	79
3	UK	100	*3*	UK	23	*3*	UK	77
4	Germany	75	*4*	Germany	19	*4*	Germany	56
5	China	53	*5*	China	12	*5*	China	41
6	Australia	39	*6*	Austria	11	*6*	Australia	30
7	Austria	32	*7*	Australia	9	*7*	France	29
7	France	32	*7*	Finland	9	*8*	Sweden	27
7	Sweden	32	*7*	Mexico	9	*9*	Austria	21
10	Taiwan	20	*7*	Russia	9	*10*	Taiwan	14

Vietnam

Agricultural Science

1998-2007			***1998-2002***			***2003-2007***		
#	*Country*	*Co-Publications*	*#*	*Country*	*Co-Publications*	*#*	*Country*	*Co-Publications*
-	EU-27	246	*-*	EU-27	90	*-*	EU-27	156
1	Japan	109	*1*	Sweden	31	*1*	Japan	81
2	France	60	*2*	Japan	28	*2*	France	42
3	Netherlands	52	*3*	France	18	*3*	Netherlands	39
4	Sweden	45	*4*	UK	17	*4*	Australia	30
5	Australia	44	*5*	Australia	14	*5*	USA	28
6	USA	41	*6*	Netherlands	13	*6*	Belgium	23
7	UK	36	*6*	USA	13	*7*	Philippines	19
8	Belgium	32	*8*	Indonesia	12	*8*	UK	19
9	Philippines	27	*9*	India	11	*9*	Thailand	16
10	Indonesia	26	*10*	Belgium	9	*10*	Germany	15

Biology and Biotechnology 1998-2007			1998-2002			2003-2007		
#	Country	Co-Publications	#	Country	Co-Publications	#	Country	Co-Publications
-	EU-27	474	-	EU-27	187	-	EU-27	287
1	Japan	175	1	France	55	1	Japan	129
2	UK	144	2	UK	54	2	USA	90
3	USA	129	3	Japan	46	3	UK	90
4	France	117	4	USA	39	4	France	62
5	Australia	81	5	Australia	36	5	Australia	45
6	Germany	80	6	Germany	34	5	Germany	46
7	Belgium	64	7	Belgium	28	7	Netherlands	42
8	Thailand	63	8	Thailand	23	8	Thailand	40
9	Netherlands	48	9	Russia	12	9	China	37
10	Russia	47	10	Sweden	11	10	Belgium	36

Chemistry 1998-2007			1998-2002			2003-2007		
#	Country	Co-Publications	#	Country	Co-Publications	#	Country	Co-Publications
-	EU-27	255	-	EU-27	108	-	EU-27	147
1	France	110	1	France	44	1	France	66
2	Japan	90	2	Belgium	30	2	Japan	60
3	Belgium	65	3	Japan	30	3	Belgium	35
4	Germany	50	4	Germany	22	4	South Korea	31
5	South Korea	39	5	USA	9	5	Germany	28
6	USA	37	6	South Korea	8	5	USA	28
7	China	13	7	Netherlands	7	7	Denmark	8
8	Australia	10	8	China	6	7	Switzerland	8
9	Denmark	9	9	Australia	5	9	Italy	7
9	Switzerland	9	9	Hungary	5	9	China	7

Energy 1998-2007			1998-2002			2003-2007		
#	Country	Co-Publications	#	Country	Co-Publications	#	Country	Co-Publications
1	Japan	19	1	Japan	10	-	EU-27	10
-	EU-27	14	-	EU-27	4	1	Japan	9
2	France	5	2	Hungary	2	2	France	4
2	South Korea	5				2	South Korea	4
4	Australia	4				4	Australia	3
4	UK	4				4	Denmark	3
6	Denmark	3				4	UK	3
6	Russia	3				4	Russia	3
8	USA	2				8	Indonesia	2
8	Thailand	2				8	China	2
8	China	2				8	Thailand	2
8	Indonesia	2						
8	India	2						
8	Hungary	2						

Geoscience								
1998-2007			1998-2002			2003-2007		
#	Country	Co-Publications	#	Country	Co-Publications	#	Country	Co-Publications
-	EU-27	152	-	EU-27	29	-	EU-27	123
1	Japan	94	1	France	24	1	Japan	72
2	France	57	2	Japan	22	2	USA	37
3	USA	54	3	USA	17	3	France	33
4	Netherlands	28	4	Netherlands	10	4	China	23
5	China	26	4	Thailand	10	5	Philippines	21
5	Philippines	26	6	Australia	7	6	Belgium	20
7	Australia	25	6	Russia	7	7	Australia	18
7	Thailand	25	6	Switzerland	7	7	Switzerland	18
7	Switzerland	25	9	Taiwan	6	7	Netherlands	18
10	Germany	21	10	Germany	5	7	UK	18
10	UK	21	10	Philippines	5			

Information Science and Computer Science								
1998-2007			1998-2002			2003-2007		
#	Country	Co-Publications	#	Country	Co-Publications	#	Country	Co-Publications
-	EU-27	34	-	EU-27	9	-	EU-27	25
1	France	16	1	France	4	1	France	12
2	Japan	9	2	Germany	3	2	Thailand	7
3	Australia	8	2	Japan	3	3	Australia	6
4	Singapore	7	4	Australia	2	3	Japan	6
5	Thailand	7	4	Singapore	2	3	USA	6
6	USA	7				6	Singapore	5
7	Germany	5				6	South Korea	5
8	South Korea	5				8	Netherlands	3
9	Canada	3				9	Canada	2
10	Netherlands	3				9	Germany	2
						9	Switzerland	2

Engineering Science								
1998-2007			1998-2002			2003-2007		
#	Country	Co-Publications	#	Country	Co-Publications	#	Country	Co-Publications
-	EU-27		-	EU-27	25	-	EU-27	58
1	Japan	43	1	Japan	12	1	Japan	31
2	South Korea	33	2	Netherlands	10	2	South Korea	30
3	Australia	24	3	Germany	7	3	Australia	20
4	Germany	20	3	Thailand	7	4	France	14
5	France	19	5	France	5	5	Germany	13
5	Netherlands	19	6	Australia	4	5	USA	13
7	Thailand	16	7	South Korea	3	7	Netherlands	9
8	USA	14	8	Malaysia	2	7	Thailand	9
9	Singapore	10	8	Poland	2	9	China	8
10	China	8	8	Singapore	2	9	Singapore	8

Materials Science 1998-2007			1998-2002			2003-2007		
#	Country	Co-Publications	#	Country	Co-Publications	#	Country	Co-Publications
-	EU-27	132	-	EU-27	62	-	EU-27	70
1	France	55	1	Netherlands	24	1	France	35
2	South Korea	34	2	France	20	2	South Korea	31
3	Netherlands	31	3	Germany	10	3	Japan	23
4	Japan	27	4	Sweden	6	4	UK	12
5	UK	14	5	Czech Republic	4	5	Austria	8
6	Germany	13	5	Japan	4	6	Netherlands	7
7	Austria	9	5	Singapore	4	6	USA	7
8	Sweden	8	8	Russia	3	8	Bangladesh	4
9	Czech Republic	7	8	South Korea	3	8	Taiwan	4
9	USA	7	10	UK	2	10	Czech Republic	3
			10	Canada	2	10	Germany	3
			10	Switzerland	2	10	Belgium	3
			10	India	2			

Mathematics 1998-2007			1998-2002			2003-2007		
#	Country	Co-Publications	#	Country	Co-Publications	#	Country	Co-Publications
-	EU-27	140	-	EU-27	65	-	EU-27	75
1	France	62	1	France	28	1	France	34
2	USA	34	2	Germany	19	2	USA	22
3	Germany	33	3	USA	12	3	South Korea	20
4	Japan	23	4	Italy	10	4	Japan	15
5	South Korea	22	5	Japan	8	5	Germany	14
6	Australia	19	6	Australia	6	6	Australia	13
7	Italy	18	7	Canada	5	7	Belgium	8
8	Belgium	9	7	UK	5	7	Italy	8
9	UK	8	9	South Korea	2	9	Taiwan	5
10	Canada	7	9	India	2	9	Thailand	5
			9	Romania	2			
			9	Kuwait	2			
			9	Croatia	2			

Medicine 1998-2007			1998-2002			2003-2007		
#	Country	Co-Publications	#	Country	Co-Publications	#	Country	Co-Publications
-	EU-27	783	-	EU-27	267	-	EU-27	516
1	USA	335	1	USA	111	1	USA	224
2	UK	245	2	UK	97	2	Japan	154
3	Japan	218	3	Japan	64	3	UK	148
4	France	179	4	France	61	4	France	118
5	Australia	141	5	Australia	52	5	Thailand	97
6	Sweden	140	6	Sweden	49	6	Sweden	91
7	Thailand	138	7	Thailand	41	7	Australia	89
8	Netherlands	105	8	Netherlands	25	8	South Korea	82
9	China	101	9	China	22	9	Netherlands	80
10	South Korea	99	10	Belgium	21	10	China	79

Multidisciplinary Journals 1998-2007			1998-2002			2003-2007		
#	Country	Co-Publications	#	Country	Co-Publications	#	Country	Co-Publications
-	EU-27	26	Due to a low number o publications, the ranking is provided for the entire period under observation only.					
2	France	13						
3	UK	8						
4	Indonesia	6						
4	Italy	6						
4	Thailand	6						
7	Germany	5						
7	China	5						
9	Australia	4						
9	Brazil	4						
9	Japan	4						

Physics 1998-2007			1998-2002			2003-2007		
#	Country	Co-Publications	#	Country	Co-Publications	#	Country	Co-Publications
-	EU-27	359	-	EU-27	148	-	EU-27	211
1	Japan	121	1	France	44	1	South Korea	83
2	France	119	2	Japan	41	2	Japan	78
3	South Korea	89	3	Netherlands	36	3	France	75
4	Germany	71	4	Germany	27	4	Germany	44
5	Belgium	48	5	Belgium	23	5	UK	39
6	Netherlands	45	6	Italy	12	6	USA	30
7	UK	44	7	USA	11	7	Belgium	25
8	USA	41	8	Sweden	10	8	Italy	22
9	Italy	34	9	Russia	9	9	Poland	17
10	Russia	24	10	India	7	10	Russia	15

Ranking of key countries without EU-27 comparison

Australia

Agricultural Science								
1998-2007			***1998-2002***			***2003-2007***		
#	*Country*	*Co-Publications*	*#*	*Country*	*Co-Publications*	*#*	*Country*	*Co-Publications*
1	USA	1154	*1*	USA	489	*1*	USA	665
2	UK	677	*2*	UK	295	*2*	UK	382
3	New Zealand	511	*3*	New Zealand	210	*3*	New Zealand	301
4	Canada	339	*4*	Canada	139	*4*	China	248
5	China	315	*5*	Germany	81	*5*	Canada	200
6	France	208	*6*	France	72	*6*	France	136
7	Germany	200	*7*	China	67	*7*	Germany	119
8	Japan	180	*8*	Japan	62	*8*	Japan	118
9	Thailand	155	*9*	Netherlands	61	*9*	Thailand	110
10	Netherlands	149	*10*	South Africa	50	*10*	Netherlands	88

Biology and Biotechnology								
1998-2007			***1998-2002***			***2003-2007***		
#	*Country*	*Co-Publications*	*#*	*Country*	*Co-Publications*	*#*	*Country*	*Co-Publications*
1	USA	8300	*1*	USA	3473	*1*	USA	4827
2	UK	3977	*2*	UK	1614	*2*	UK	2363
3	Germany	2153	*3*	Germany	829	*3*	Germany	1324
4	Canada	1496	*4*	Canada	635	*4*	Canada	861
5	New Zealand	1466	*5*	New Zealand	609	*5*	New Zealand	857
6	France	1408	*6*	France	571	*6*	France	837
7	Japan	1320	*7*	Japan	534	*7*	Japan	786
8	China	1038	*8*	Netherlands	318	*8*	China	772
9	Sweden	812	*9*	Sweden	307	*9*	Sweden	505
10	Netherlands	764	*10*	China	266	*10*	Netherlands	446

Chemistry								
1998-2007			***1998-2002***			***2003-2007***		
#	*Country*	*Co-Publications*	*#*	*Country*	*Co-Publications*	*#*	*Country*	*Co-Publications*
1	USA	1774	*1*	USA	733	*1*	USA	1041
2	UK	1183	*2*	UK	525	*2*	UK	658
3	Germany	769	*3*	Germany	289	*3*	China	545
4	China	724	*4*	Japan	243	*4*	Germany	480
5	Japan	570	*5*	New Zealand	187	*5*	Japan	327
6	France	403	*6*	China	179	*6*	France	239
7	New Zealand	374	*7*	France	164	*7*	New Zealand	187
8	Canada	294	*8*	Canada	113	*8*	Italy	181
9	Italy	290	*9*	Sweden	110	*8*	Canada	181
10	Sweden	246	*10*	Italy	109	*10*	Sweden	136

Energy

1998-2007			1998-2002			2003-2007		
#	Country	Co-Publications	#	Country	Co-Publications	#	Country	Co-Publications
1	USA	349	1	USA	181	1	USA	168
2	Germany	184	2	Germany	92	2	Japan	115
3	Japan	176	3	UK	65	3	Germany	92
4	UK	147	4	Japan	61	4	UK	82
5	China	97	5	China	40	5	China	57
6	France	63	6	France	33	6	France	30
7	Canada	60	7	Canada	32	7	Canada	28
8	Switzerland	45	8	Russia	23	8	Netherlands	26
9	Russia	44	9	Sweden	22	8	South Korea	26
10	Netherlands	43	9	Switzerland	22	10	Poland	25
10	Poland	43				10	Taiwan	25

Geoscience

1998-2007			1998-2002			2003-2007		
#	Country	Co-Publications	#	Country	Co-Publications	#	Country	Co-Publications
1	USA	4013	1	USA	1686	1	USA	2327
2	UK	2245	2	UK	880	2	UK	1365
3	Canada	1183	3	Canada	483	3	China	877
4	China	1156	4	Germany	446	4	Canada	700
5	Germany	1099	5	New Zealand	356	5	Germany	653
6	New Zealand	874	6	France	289	6	New Zealand	518
7	France	780	7	China	279	7	France	491
8	Japan	737	7	Japan	279	8	Japan	458
9	Netherlands	388	9	South Africa	156	9	Netherlands	250
10	South Africa	353	10	Netherlands	138	10	Italy	224

Information Science and Computer Science

1998-2007			1998-2002			2003-2007		
#	Country	Co-Publications	#	Country	Co-Publications	#	Country	Co-Publications
1	USA	1048	1	USA	467	1	USA	581
2	China	611	2	UK	229	2	China	463
3	UK	551	3	China	148	3	UK	322
4	Germany	341	4	Germany	131	4	Germany	210
5	Canada	256	5	Canada	110	5	Singapore	156
6	Singapore	241	6	Singapore	85	6	Canada	146
7	France	185	7	Japan	71	7	France	124
8	Japan	168	8	France	61	8	Netherlands	103
9	Netherlands	141	9	New Zealand	45	9	Japan	97
10	Italy	118	10	Netherlands	38	10	Italy	81

Engineering Science 1998-2007			1998-2002			2003-2007		
#	Country	Co-Publications	#	Country	Co-Publications	#	Country	Co-Publications
1	USA	2190	1	USA	1004	1	USA	1186
2	China	1390	2	UK	481	2	China	1017
3	UK	1234	3	China	373	3	UK	753
4	Japan	641	4	Japan	267	4	Japan	374
5	Canada	617	5	Canada	259	5	Canada	358
6	Singapore	530	6	Singapore	209	6	Singapore	321
7	Germany	504	7	Germany	203	7	Germany	301
8	France	464	8	France	193	8	France	271
9	Sweden	262	9	Sweden	108	9	South Korea	170
10	South Korea	247	10	Italy	96	10	New Zealand	163

Materials Science 1998-2007			1998-2002			2003-2007		
#	Country	Co-Publications	#	Country	Co-Publications	#	Country	Co-Publications
1	China	772	1	USA	287	1	China	583
2	USA	714	2	Japan	208	2	USA	427
3	UK	442	3	China	189	3	UK	259
4	Japan	385	4	UK	183	4	Germany	222
5	Germany	366	5	Germany	144	5	Japan	177
6	Singapore	254	6	Singapore	120	6	Singapore	134
7	Canada	168	7	France	63	7	Canada	106
8	France	164	8	Canada	62	8	France	101
9	South Korea	133	9	South Korea	46	9	New Zealand	88
10	New Zealand	131	10	Sweden	43	10	South Korea	87
			10	New Zealand	43			

Mathematics 1998-2007			1998-2002			2003-2007		
#	Country	Co-Publications	#	Country	Co-Publications	#	Country	Co-Publications
1	USA	1097	1	USA	513	1	USA	584
2	UK	668	2	UK	317	2	China	444
3	China	654	3	China	210	3	UK	351
4	Canada	374	4	Canada	181	4	Canada	193
5	Germany	286	5	Germany	140	5	Germany	146
6	Spain	172	6	New Zealand	77	6	France	82
7	New Zealand	159	7	France	74	6	New Zealand	82
8	France	156	8	Italy	66	8	Spain	70
9	Italy	129	9	Russia	64	9	Singapore	66
10	Russia	116	10	Japan	56	10	Italy	63
			10	Netherlands	56			

Medicine

1998-2007			1998-2002			2003-2007		
#	Country	Co-Publications	#	Country	Co-Publications	#	Country	Co-Publications
1	USA	16331	1	USA	6269	1	USA	10062
2	UK	10588	2	UK	3868	2	UK	6720
3	Canada	4177	3	Canada	1424	3	Canada	2753
4	Germany	4000	4	Germany	1326	4	Germany	2674
5	France	2633	5	New Zealand	949	5	France	1730
6	New Zealand	2630	6	Japan	927	6	New Zealand	1681
7	Italy	2188	7	France	903	7	Italy	1523
8	Japan	2124	8	Italy	665	8	Netherlands	1397
9	Netherlands	2054	9	Sweden	659	9	China	1283
10	Switzerland	1857	10	Netherlands	657	10	Switzerland	1210

Multidisciplinary Journals

1998-2007			1998-2002			2003-2007		
#	Country	Co-Publications	#	Country	Co-Publications	#	Country	Co-Publications
1	USA	863	1	USA	346	1	USA	517
2	UK	384	2	UK	154	2	UK	230
3	Germany	197	3	Germany	73	3	Germany	124
4	France	132	4	France	44	4	France	88
5	Canada	119	5	Japan	43	5	Canada	77
6	China	105	6	Canada	42	6	China	74
7	Japan	101	6	Sweden	42	7	Japan	58
8	Sweden	88	8	China	31	8	New Zealand	51
9	Netherlands	73	9	South Africa	27	9	Netherlands	50
10	Italy	69	10	Italy	23	10	Italy	46
			10	Netherlands	23	10	Sweden	46

Nanotechnology

1998-2007			1998-2002			2003-2007		
#	Country	Co-Publications	#	Country	Co-Publications	#	Country	Co-Publications
1	USA	107	1	USA	38	1	USA	69
2	UK	62	2	UK	21	2	UK	41
3	Germany	45	3	Japan	20	3	Germany	29
4	Japan	44	4	Germany	16	4	Japan	24
5	Canada	22	5	China	15	5	Canada	16
6	South Korea	21	6	Canada	6	5	Taiwan	16
7	Taiwan	18	6	Singapore	6	5	South Korea	16
8	New Zealand	16	8	Russia	5	5	New Zealand	16
9	China	15	8	South Korea	5	9	France	12
10	France	14	10	Israel	4	10	Iran	8

Physics 1998-2007			1998-2002			2003-2007		
#	Country	Co-Publications	#	Country	Co-Publications	#	Country	Co-Publications
1	USA	5272	1	USA	2367	1	USA	2905
2	UK	2707	2	UK	1216	2	UK	1491
3	Germany	2001	3	Germany	794	3	Germany	1207
4	China	1519	4	Japan	594	4	China	1074
5	Japan	1396	5	France	467	5	Japan	802
6	France	1085	6	China	445	6	France	618
7	Canada	929	7	Canada	382	7	Canada	547
8	Italy	744	8	Italy	306	8	Italy	438
9	Russia	702	9	Russia	267	9	Russia	435
10	Switzerland	574	10	Netherlands	242	10	Switzerland	387

China

Agricultural Science 1998-2007			1998-2002			2003-2007		
#	Country	Co-Publications	#	Country	Co-Publications	#	Country	Co-Publications
1	USA	1369	1	USA	315	1	USA	1054
2	Japan	622	2	Japan	165	2	Japan	457
3	Canada	393	3	UK	105	3	Canada	306
4	Australia	315	4	Canada	87	4	Australia	248
5	UK	265	5	Australia	67	5	Germany	185
6	Germany	246	6	Germany	61	6	UK	160
7	Netherlands	140	7	Netherlands	38	7	Netherlands	102
7	South Korea	114	8	Philippines	26	8	South Korea	92
7	France	110	9	France	24	9	France	86
7	Philippines	92	10	South Korea	22	10	Philippines	66

Biology and Biotechnology 1998-2007			1998-2002			2003-2007		
#	Country	Co-Publications	#	Country	Co-Publications	#	Country	Co-Publications
1	USA	7599	1	USA	1877	1	USA	5722
2	Japan	2611	2	Japan	836	2	Japan	1775
3	UK	1840	3	UK	552	3	UK	1288
4	Germany	1495	4	Germany	416	4	Germany	1079
5	Canada	1109	5	Australia	266	5	Canada	867
6	Australia	1038	6	Canada	242	6	Australia	772
7	France	814	7	France	224	7	France	590
8	South Korea	491	8	Netherlands	120	8	South Korea	403
9	Singapore	441	9	Taiwan	112	9	Singapore	358
10	Netherlands	401	10	Sweden	107	10	Netherlands	281

Chemistry 1998-2007			1998-2002			2003-2007		
#	Country	Co-Publications	#	Country	Co-Publications	#	Country	Co-Publications
1	USA	5249	1	USA	1641	1	USA	3608
2	Japan	3752	2	Japan	1319	2	Japan	2433
3	Germany	1846	3	Germany	600	3	Germany	1246
4	UK	1210	4	UK	389	4	UK	821
5	France	897	5	Hong Kong	285	5	France	662
6	Canada	889	6	Canada	237	6	Canada	652
7	South Korea	789	7	France	235	7	South Korea	651
8	Singapore	782	8	Singapore	223	8	Singapore	559
9	Australia	722	9	Australia	179	9	Australia	543
10	Taiwan	554	10	Taiwan	177	10	Taiwan	377

Energy 1998-2007			1998-2002			2003-2007		
#	Country	Co-Publications	#	Country	Co-Publications	#	Country	Co-Publications
1	USA	556	1	USA	182	1	USA	374
2	Japan	417	2	Japan	145	2	Japan	272
3	Germany	202	3	Germany	77	3	Germany	125
4	Canada	160	4	UK	49	4	Canada	118
5	UK	159	5	Italy	46	5	UK	110
6	Australia	96	6	Russia	43	6	South Korea	77
7	Italy	94	7	Canada	42	7	France	57
8	South Korea	93	8	Australia	40	8	Australia	56
9	Russia	89	9	Sweden	30	9	Italy	48
10	France	85	10	France	28	10	Russia	46

Geoscience 1998-2007			1998-2002			2003-2007		
#	Country	Co-Publications	#	Country	Co-Publications	#	Country	Co-Publications
1	USA	4612	1	USA	1119	1	USA	3493
2	Japan	1798	2	Japan	524	2	Japan	1274
3	UK	1235	3	Germany	363	3	UK	881
4	Australia	1155	4	UK	354	4	Australia	876
5	Germany	1078	5	Australia	279	5	Canada	745
6	Canada	996	6	Canada	251	6	Germany	715
7	France	633	7	France	204	7	France	429
8	South Korea	321	8	Netherlands	84	8	South Korea	262
9	Taiwan	307	9	Taiwan	75	9	Taiwan	232
10	Netherlands	275	10	Russia	71	10	Netherlands	191

Information Science and Computer Science 1998-2007			1998-2002			2003-2007		
#	Country	Co-Publications	#	Country	Co-Publications	#	Country	Co-Publications
1	USA	2566	1	USA	666	1	USA	1900
2	UK	759	2	Canada	184	2	UK	618
3	Canada	695	3	Japan	153	3	Singapore	521
4	Singapore	635	4	Australia	148	4	Canada	511
5	Japan	617	5	UK	141	5	Japan	464
6	Australia	611	6	Singapore	114	6	Australia	463
7	Germany	307	7	Germany	88	7	Germany	219
8	South Korea	219	8	Hong Kong	75	8	South Korea	179
9	France	214	9	France	44	9	France	170
10	Taiwan	193	10	South Korea	40	10	Taiwan	155

Engineering Science 1998-2007			1998-2002			2003-2007		
#	Country	Co-Publications	#	Country	Co-Publications	#	Country	Co-Publications
1	USA	5811	1	USA	1800	1	USA	4011
2	Japan	2836	2	Japan	947	2	Japan	1889
3	UK	2324	3	UK	702	3	UK	1622
4	Singapore	1625	4	Canada	454	4	Singapore	1203
5	Canada	1577	5	Germany	424	5	Canada	1123
6	Australia	1387	6	Singapore	422	6	Australia	1014
7	Germany	1209	7	Australia	373	7	Germany	785
8	South Korea	726	8	Hong Kong	242	8	South Korea	542
9	France	665	9	France	187	9	France	478
10	Taiwan	471	10	South Korea	184	10	Taiwan	345

Materials Science 1998-2007			1998-2002			2003-2007		
#	Country	Co-Publications	#	Country	Co-Publications	#	Country	Co-Publications
1	Japan	2663	1	Japan	943	1	USA	1832
2	USA	2648	2	USA	816	2	Japan	1720
3	Germany	1211	3	Germany	444	3	Germany	767
4	UK	918	4	UK	310	4	UK	608
5	Australia	770	5	Singapore	240	5	Australia	581
6	Malaysia	738	6	South Korea	213	6	Malaysia	572
7	South Korea	710	7	Australia	189	7	South Korea	497
8	Singapore	697	8	Hong Kong	167	8	Singapore	457
9	France	560	9	Malaysia	166	9	France	401
10	Canada	430	10	France	159	10	Canada	315

Mathematics

1998-2007			1998-2002			2003-2007		
#	Country	Co-Publications	#	Country	Co-Publications	#	Country	Co-Publications
1	USA	3064	1	USA	1023	1	USA	2041
2	Canada	926	2	Canada	264	2	Canada	662
3	UK	694	3	Germany	256	3	UK	476
4	Australia	653	4	UK	218	4	Australia	443
5	Germany	627	5	Japan	213	5	Germany	371
6	Japan	570	6	Australia	210	6	Japan	357
7	Singapore	401	7	France	132	7	Singapore	285
8	South Korea	392	8	Hong Kong	129	8	South Korea	281
9	France	390	9	Singapore	116	9	France	258
10	Taiwan	347	10	South Korea	111	10	Taiwan	253

Medicine

1998-2007			1998-2002			2003-2007		
#	Country	Co-Publications	#	Country	Co-Publications	#	Country	Co-Publications
1	USA	12273	1	USA	3247	1	USA	9026
2	Japan	3715	2	Japan	1194	2	Japan	2521
3	UK	2855	3	UK	875	3	UK	1980
4	Germany	1736	4	Germany	504	4	Australia	1282
5	Australia	1726	5	Australia	444	5	Germany	1232
6	Canada	1604	6	Canada	416	6	Canada	1188
7	France	1105	7	France	275	7	France	830
8	Sweden	851	8	Sweden	273	8	South Korea	612
9	South Korea	760	9	Hong Kong	204	9	Singapore	608
10	Singapore	740	10	Taiwan	179	10	Sweden	578

Multidisciplinary Journals

1998-2007			1998-2002			2003-2007		
#	Country	Co-Publications	#	Country	Co-Publications	#	Country	Co-Publications
1	USA	1004	1	USA	371	1	USA	633
2	UK	221	2	Japan	67	2	UK	160
3	Japan	199	3	Germany	63	3	Japan	132
4	Germany	193	4	UK	61	4	Germany	130
5	France	124	5	France	44	5	Canada	85
6	Canada	116	6	Australia	31	6	France	80
7	Australia	105	6	Canada	31	7	Australia	74
8	Taiwan	64	8	Taiwan	27	8	Taiwan	37
9	Sweden	45	9	South Korea	13	9	Sweden	34
10	Singapore	42	10	Hong Kong	12	10	Singapore	33

Nanotechnology 1998-2007			1998-2002			2003-2007		
#	Country	Co-Publications	#	Country	Co-Publications	#	Country	Co-Publications
1	USA	496	1	USA	86	1	USA	410
2	Japan	295	2	Japan	56	2	Japan	239
3	Germany	178	3	Germany	50	3	Germany	128
4	UK	144	4	UK	36	4	UK	108
5	Singapore	118	5	Singapore	24	5	Singapore	94
6	Australia	97	6	South Korea	23	6	Australia	82
7	South Korea	96	7	France	17	7	South Korea	73
8	France	77	8	Australia	15	8	France	60
9	Canada	47	9	Hong Kong	12	9	Canada	39
10	Sweden	30	10	Belgium	10	10	Sweden	27

Physics 1998-2007			1998-2002			2003-2007		
#	Country	Co-Publications	#	Country	Co-Publications	#	Country	Co-Publications
1	USA	9932	1	USA	3232	1	USA	6700
2	Japan	4562	2	Japan	1665	2	Japan	2897
3	Germany	4197	3	Germany	1626	3	Germany	2571
4	UK	2744	4	UK	892	4	UK	1852
5	France	2168	5	France	727	5	France	1441
6	Russia	1798	6	Italy	682	6	Russia	1210
7	South Korea	1657	7	Russia	588	7	Canada	1205
8	Canada	1656	8	South Korea	586	8	Singapore	1077
9	Italy	1587	9	Taiwan	482	9	South Korea	1071
10	Singapore	1541	10	Singapore	464	10	Australia	1070

Iran

Agricultural Science 1998-2007			1998-2002			2003-2007		
#	Country	Co-Publications	#	Country	Co-Publications	#	Country	Co-Publications
1	Canada	114	1	Canada	22	1	Canada	92
2	USA	97	2	USA	18	2	USA	79
3	Australia	59	3	Australia	15	3	UK	45
4	UK	57	4	UK	12	4	Australia	44
5	India	31	5	India	7	5	India	24
6	France	24	6	Japan	5	6	France	23
7	Japan	23	7	South Africa	3	7	Japan	18
8	Netherlands	20	7	Netherlands	3	8	Netherlands	17
9	Belgium	18	7	Belgium	3	9	Belgium	15
10	Germany	17	7	Germany	3	10	Germany	14
						10	Malaysia	14

Biology and Biotechnology 1998-2007			1998-2002			2003-2007		
#	Country	Co-Publications	#	Country	Co-Publications	#	Country	Co-Publications
1	USA	224	1	UK	54	1	USA	174
2	UK	219	2	USA	50	2	UK	165
3	Canada	129	3	Canada	28	3	Canada	101
4	Germany	105	4	Australia	27	4	Germany	90
5	France	99	5	Japan	16	5	France	84
6	Australia	91	6	Germany	15	6	Australia	64
7	Japan	72	6	France	15	7	Japan	56
8	Netherlands	55	8	Belgium	13	8	Netherlands	50
9	India	52	9	Russia	9	9	India	43
10	Italy	42	9	India	9	10	Italy	35

Chemistry 1998-2007			1998-2002			2003-2007		
#	Country	Co-Publications	#	Country	Co-Publications	#	Country	Co-Publications
1	USA	231	1	UK	70	1	USA	183
2	UK	203	2	Canada	50	2	Germany	143
3	Germany	173	3	USA	48	3	UK	133
4	Canada	171	4	Australia	38	4	Canada	121
5	Australia	106	5	Germany	30	5	France	76
6	France	89	6	Taiwan	17	6	Australia	68
7	Italy	62	6	India	17	7	Italy	51
8	Sweden	51	8	France	13	8	China	46
9	China	47	9	Italy	11	9	Sweden	44
10	India	45	9	Japan	11	10	India	28

Energy 1998-2007			1998-2002			2003-2007		
#	Country	Co-Publications	#	Country	Co-Publications	#	Country	Co-Publications
1	USA	58	1	USA	19	1	USA	39
2	Canada	36	2	Canada	10	2	Canada	26
3	UK	32	2	UK	10	3	UK	22
4	Australia	11	4	France	3	4	Italy	10
4	Italy	11	4	Japan	3	5	Australia	9
6	France	6	6	Australia	2	6	Norway	5
7	Belgium	5	6	Germany	2	6	China	5
7	Germany	5	6	Qatar	2	8	Kuwait	4
7	Japan	5	6	Austria	2	8	Belgium	4
7	Norway	5				8	Switzerland	4
7	China	5						
7	Switzerland	5						

Geoscience 1998-2007			1998-2002			2003-2007		
#	Country	Co-Publications	#	Country	Co-Publications	#	Country	Co-Publications
1	USA	183	1	USA	60	1	USA	123
2	UK	145	2	Canada	35	2	UK	111
3	Canada	122	3	UK	34	3	Canada	87
4	France	86	4	Australia	19	4	France	77
5	Australia	68	5	Germany	11	5	Germany	57
6	Germany	68	6	Netherlands	11	6	Australia	49
7	Japan	37	7	France	9	7	Japan	30
8	Netherlands	29	8	Japan	7	8	Sweden	18
9	Sweden	24	9	Sweden	6	9	Netherlands	18
10	India	20	10	India	6	10	Switzerland	17

Information Science and Computer Science 1998-2007			1998-2002			2003-2007		
#	Country	Co-Publications	#	Country	Co-Publications	#	Country	Co-Publications
1	USA	100	1	USA	32	1	USA	68
2	Canada	83	2	UK	16	2	Canada	67
3	UK	77	2	Canada	16	3	UK	61
4	Australia	30	4	Australia	12	4	Australia	18
5	Germany	18	5	Germany	3	5	Germany	15
6	France	17	5	Japan	3	5	France	15
7	Japan	13	7	Switzerland	2	7	Japan	10
8	Italy	11	7	Italy	2	7	Netherlands	10
8	Netherlands	11	7	France	2	9	Italy	9
10	South Korea	6	7	Yugoslavia	2	10	South Korea	6

Engineering Science 1998-2007			1998-2002			2003-2007		
#	Country	Co-Publications	#	Country	Co-Publications	#	Country	Co-Publications
1	Canada	516	1	USA	141	1	Canada	389
2	USA	420	2	Canada	127	2	USA	279
3	UK	347	3	UK	108	3	UK	239
4	Australia	131	4	Australia	47	4	Australia	84
5	Germany	96	5	France	24	5	Germany	79
6	Japan	85	6	Japan	23	6	Japan	62
7	France	84	7	Germany	17	7	France	60
8	India	45	8	India	11	8	India	34
9	Netherlands	37	9	Netherlands	8	9	Netherlands	29
10	Switzerland	29	10	Qatar	7	10	Switzerland	24

Materials Science 1998-2007			1998-2002			2003-2007		
#	Country	Co-Publications	#	Country	Co-Publications	#	Country	Co-Publications
1	Canada	129	1	USA	34	1	Canada	107
2	USA	122	2	UK	30	2	USA	88
3	UK	72	3	Canada	22	3	UK	42
4	Australia	31	4	Australia	13	4	Germany	20
5	Germany	23	5	France	4	5	Australia	18
6	France	22	5	Sweden	4	6	France	18
7	India	13	7	Italy	3	7	China	13
7	China	13	7	India	3	8	Kuwait	12
9	Italy	12	7	Germany	3	9	South Korea	11
9	Kuwait	12	10	New Zealand	2	10	India	10
9	South Korea	12						

Mathematics 1998-2007			1998-2002			2003-2007		
#	Country	Co-Publications	#	Country	Co-Publications	#	Country	Co-Publications
1	UK	183	1	UK	53	1	UK	130
2	Canada	109	2	Canada	27	2	Canada	82
3	USA	62	3	USA	13	3	USA	49
4	Australia	55	4	Australia	12	4	Germany	47
5	Germany	51	5	Malaysia	8	5	France	43
6	France	47	6	Japan	7	5	Australia	43
7	Japan	37	7	France	4	7	Japan	30
8	Malaysia	34	7	Germany	4	8	Malaysia	26
9	Switzerland	21	9	Austria	3	9	Switzerland	19
10	Italy	20	9	Italy	3	10	Italy	17
			9	India	3			
			9	New Zealand	3			

Medicine 1998-2007			1998-2002			2003-2007		
#	Country	Co-Publications	#	Country	Co-Publications	#	Country	Co-Publications
1	USA	610	1	UK	138	1	USA	483
2	UK	475	2	USA	127	2	UK	337
3	Canada	243	3	Canada	53	3	Canada	190
4	Australia	142	4	Australia	31	4	Australia	111
5	Japan	111	5	Italy	30	5	Sweden	90
6	Germany	110	6	Japan	28	6	Germany	89
7	Sweden	106	7	France	23	7	Japan	83
8	France	99	8	Germany	21	8	France	76
9	Italy	94	9	India	18	9	Italy	64
10	Switzerland	50	10	Sweden	16	10	Russia	41

Multidisciplinary Journals								
1998-2007			1998-2002			2003-2007		
#	Country	Co-Publications	#	Country	Co-Publications	#	Country	Co-Publications
1	USA	30	1	USA	14	1	Canada	17
2	UK	24	2	UK	11	2	USA	16
3	Canada	21	3	Australia	5	3	UK	13
4	Australia	9	4	Canada	4	4	India	6
4	India	9	5	India	3	5	Japan	5
6	France	5	5	Russia	3	6	Australia	4
6	Japan	5	7	Sweden	2	6	France	4
8	Germany	3				8	Netherlands	2
8	Netherlands	3				8	Germany	2
8	Russia	3						
8	Sweden	3						

Nanotechnology								
1998-2007			1998-2002			2003-2007		
#	Country	Co-Publications	#	Country	Co-Publications	#	Country	Co-Publications
1	Canada	9	1	UK	3	1	Canada	8
1	UK	9				1	Germany	8
3	Germany	8				1	Australia	8
3	Australia	8				1	USA	8
3	USA	8				5	UK	6
6	France	6				5	France	6
7	Japan	5				7	Japan	5
7	India	5				8	Switzerland	4
9	Switzerland	4				8	India	4

Physics								
1998-2007			1998-2002			2003-2007		
#	Country	Co-Publications	#	Country	Co-Publications	#	Country	Co-Publications
1	USA	301	1	USA	94	1	USA	207
2	UK	215	2	Canada	66	2	UK	149
3	Canada	207	2	UK	66	3	Canada	141
4	Germany	136	4	Italy	36	4	Germany	108
5	France	128	5	Germany	28	5	France	107
6	Italy	102	6	France	21	6	Italy	66
7	Japan	76	7	Rep of Georgia	17	7	Japan	64
8	Russia	62	8	India	16	8	Australia	50
9	India	61	9	Russia	14	9	Russia	48
10	Australia	56	10	Japan	12	10	India	45
			10	Azerbaijan	12			
			10	Turkey	12			

Japan

Agricultural Science								
1998-2007			***1998-2002***			***2003-2007***		
#	*Country*	*Co-Publications*	*#*	*Country*	*Co-Publications*	*#*	*Country*	*Co-Publications*
1	USA	1135	*1*	USA	463	*1*	USA	672
2	China	622	*2*	China	165	*2*	China	457
3	South Korea	440	*3*	South Korea	160	*3*	South Korea	280
4	Thailand	381	*4*	Thailand	125	*4*	Thailand	256
5	Canada	230	*5*	UK	95	*5*	Canada	142
6	UK	217	*6*	Canada	88	*6*	UK	122
7	Philippines	184	*7*	Philippines	65	*7*	Philippines	119
8	Australia	180	*8*	Indonesia	64	*8*	Australia	118
9	Germany	172	*9*	Australia	62	*9*	Germany	113
10	Indonesia	168	*10*	India	59	*10*	Indonesia	104
			10	Germany	59			

Biology and Biotechnology								
1998-2007			***1998-2002***			***2003-2007***		
#	*Country*	*Co-Publications*	*#*	*Country*	*Co-Publications*	*#*	*Country*	*Co-Publications*
1	USA	15480	*1*	USA	7077	*1*	USA	8403
2	UK	3027	*2*	UK	1299	*2*	China	1775
3	China	2611	*3*	Germany	1054	*3*	UK	1728
4	Germany	2507	*4*	China	836	*4*	Germany	1453
5	France	1736	*5*	France	756	*5*	South Korea	1063
6	Canada	1694	*6*	Canada	735	*6*	France	980
7	South Korea	1679	*7*	South Korea	616	*7*	Canada	959
8	Australia	1320	*8*	Australia	534	*8*	Australia	786
9	Thailand	923	*9*	Sweden	335	*9*	Thailand	605
10	Netherlands	715	*10*	Thailand	318	*10*	Netherlands	418

Chemistry								
1998-2007			***1998-2002***			***2003-2007***		
#	*Country*	*Co-Publications*	*#*	*Country*	*Co-Publications*	*#*	*Country*	*Co-Publications*
1	USA	5890	*1*	USA	2737	*1*	USA	3153
2	China	3756	*2*	China	1319	*2*	China	2437
3	Germany	1828	*3*	Germany	850	*3*	South Korea	1009
4	South Korea	1711	*4*	South Korea	702	*4*	Germany	978
5	UK	1422	*5*	UK	697	*5*	France	768
6	France	1305	*6*	France	537	*6*	UK	725
7	India	901	*7*	Russia	395	*7*	India	602
8	Russia	832	*8*	Canada	388	*8*	Russia	437
9	Canada	780	*9*	India	299	*9*	Canada	392
10	Italy	608	*10*	Italy	251	*10*	Thailand	363

Energy 1998-2007			1998-2002			2003-2007		
#	Country	Co-Publications	#	Country	Co-Publications	#	Country	Co-Publications
1	USA	1352	1	USA	664	1	USA	688
2	Germany	677	2	Germany	345	2	Germany	332
3	Russia	521	3	Russia	238	3	Russia	283
4	China	419	4	China	145	4	China	274
5	France	280	5	UK	132	5	France	168
6	UK	273	6	Italy	115	6	South Korea	163
7	South Korea	256	7	France	112	7	UK	141
8	Italy	236	8	South Korea	93	8	Switzerland	122
9	Switzerland	194	9	Switzerland	72	9	Italy	121
10	Australia	176	10	Australia	61	10	Australia	115

Geoscience 1998-2007			1998-2002			2003-2007		
#	Country	Co-Publications	#	Country	Co-Publications	#	Country	Co-Publications
1	USA	4510	1	USA	1782	1	USA	2728
2	China	1800	2	China	524	2	China	1276
3	Germany	1067	3	Germany	413	3	UK	660
4	UK	1017	4	UK	357	4	Germany	654
5	France	807	5	Russia	319	5	France	514
6	Canada	747	6	Canada	302	6	Australia	458
7	Russia	745	7	France	293	7	Canada	445
8	Australia	737	8	Australia	279	8	Russia	426
9	South Korea	582	9	India	176	9	South Korea	423
10	India	435	10	South Korea	159	10	India	259

Information Science and Computer Science 1998-2007			1998-2002			2003-2007		
#	Country	Co-Publications	#	Country	Co-Publications	#	Country	Co-Publications
1	USA	1352	1	USA	642	1	USA	710
2	China	617	2	China	153	2	China	464
3	Germany	338	3	Germany	137	3	Germany	201
4	UK	282	4	Canada	123	4	South Korea	169
5	Canada	276	5	UK	122	5	UK	160
6	South Korea	252	6	South Korea	83	6	Canada	153
7	France	198	7	France	80	7	France	118
8	Australia	168	8	Australia	71	8	Australia	97
9	Italy	102	9	Netherlands	52	9	Taiwan	70
10	Taiwan	98	10	Singapore	39	10	Italy	63
			10	Italy	39			

Engineering Science 1998-2007			1998-2002			2003-2007		
#	Country	Co-Publications	#	Country	Co-Publications	#	Country	Co-Publications
1	USA	5572	1	USA	2686	1	USA	2886
2	China	2849	2	China	947	2	China	1902
3	South Korea	1774	3	South Korea	643	3	South Korea	1131
4	Germany	1235	4	UK	587	4	Germany	685
5	UK	970	5	Germany	550	5	Canada	469
6	Canada	859	6	Canada	390	6	France	450
7	France	812	7	France	362	7	UK	383
8	Russia	692	8	Russia	321	8	Australia	374
9	Australia	641	9	Australia	267	9	Russia	371
10	India	499	10	Italy	221	10	Taiwan	310

Materials Science 1998-2007			1998-2002			2003-2007		
#	Country	Co-Publications	#	Country	Co-Publications	#	Country	Co-Publications
1	USA	3300	1	USA	1572	1	USA	1728
2	China	2667	2	China	943	2	China	1724
3	South Korea	1670	3	Germany	678	3	South Korea	1036
4	Germany	1347	4	South Korea	634	4	Germany	669
5	UK	1079	5	UK	513	5	UK	566
6	France	912	6	France	402	6	France	510
7	Russia	710	7	Russia	327	7	India	391
8	India	634	8	India	243	8	Russia	383
9	Australia	385	9	Australia	208	9	Canada	201
10	Canada	365	10	Canada	164	10	Taiwan	198

Mathematics 1998-2007			1998-2002			2003-2007		
#	Country	Co-Publications	#	Country	Co-Publications	#	Country	Co-Publications
1	USA	1197	1	USA	542	1	USA	655
2	China	570	2	China	212	2	China	358
3	Germany	378	3	Germany	157	3	Germany	221
4	France	312	4	France	130	4	France	182
5	Canada	253	5	Canada	117	5	South Korea	166
6	South Korea	240	6	UK	98	6	Canada	136
7	UK	217	7	Italy	79	7	UK	119
8	Italy	181	8	South Korea	74	8	Italy	102
9	Taiwan	118	9	Australia	56	9	Taiwan	86
10	Australia	107	10	Russia	46	10	Spain	63

Medicine

1998-2007			1998-2002			2003-2007		
#	Country	Co-Publications	#	Country	Co-Publications	#	Country	Co-Publications
1	USA	30927	1	USA	14185	1	USA	16742
2	UK	5132	2	UK	2252	2	UK	2880
3	Germany	4042	3	Germany	1783	3	China	2526
4	China	3720	4	Canada	1334	4	Germany	2259
5	Canada	2825	5	China	1194	5	Canada	1491
6	France	2409	6	France	1010	6	France	1399
7	Australia	2124	7	Australia	927	7	South Korea	1312
8	South Korea	2047	8	Sweden	780	8	Australia	1197
9	Italy	1818	9	Italy	742	9	Italy	1076
10	Sweden	1604	10	South Korea	735	10	Netherlands	855

Multidisciplinary Journals

1998-2007			1998-2002			2003-2007		
#	Country	Co-Publications	#	Country	Co-Publications	#	Country	Co-Publications
1	USA	1729	1	USA	775	1	USA	954
2	UK	337	2	UK	128	2	UK	209
3	Germany	259	3	Germany	104	3	Germany	155
4	France	238	4	France	98	4	France	140
5	China	199	5	Canada	72	5	China	132
6	Canada	190	6	China	67	6	Canada	118
7	Australia	101	7	Netherlands	47	7	Australia	58
8	Italy	99	8	Australia	43	8	Italy	57
9	Switzerland	93	9	Italy	42	9	Switzerland	53
10	Netherlands	85	10	Switzerland	40	10	Sweden	48

Nanotechnology

1998-2007			1998-2002			2003-2007		
#	Country	Co-Publications	#	Country	Co-Publications	#	Country	Co-Publications
1	USA	544	1	USA	206	1	USA	338
2	China	296	2	Germany	61	2	China	240
3	South Korea	181	3	China	56	3	South Korea	144
4	Germany	161	4	UK	54	4	Germany	100
5	UK	141	5	France	42	5	UK	87
6	France	116	6	South Korea	37	6	France	74
7	India	84	7	Russia	24	7	India	62
8	Russia	62	8	India	22	8	Taiwan	44
9	Taiwan	53	8	Poland	22	9	Russia	38
10	Poland	46	10	Australia	20	10	Canada	26

Physics 1998-2007			1998-2002			2003-2007		
#	Country	Co-Publications	#	Country	Co-Publications	#	Country	Co-Publications
1	USA	14524	1	USA	6653	1	USA	7871
2	Germany	6497	2	Germany	2947	2	Germany	3550
3	China	4568	3	Russia	2048	3	China	2903
4	Russia	4450	4	UK	1872	4	UK	2425
5	UK	4297	5	China	1665	5	Russia	2402
6	France	3710	6	France	1457	6	France	2253
7	South Korea	3311	7	South Korea	1086	7	South Korea	2225
8	Italy	2655	8	Italy	1076	8	Italy	1579
9	Canada	2157	9	Canada	954	9	Canada	1203
10	Switzerland	2013	10	Switzerland	874	10	India	1152

New Zealand

Agricultural Science 1998-2007			1998-2002			2003-2007		
#	Country	Co-Publications	#	Country	Co-Publications	#	Country	Co-Publications
1	USA	641	1	USA	264	1	USA	377
2	Australia	511	2	Australia	210	2	Australia	301
3	UK	282	3	UK	118	3	UK	164
4	Canada	166	4	Canada	78	4	Canada	88
5	France	111	5	France	43	5	France	68
6	Germany	87	6	Germany	39	6	Ireland	55
7	Netherlands	82	7	Netherlands	35	7	Germany	48
8	Ireland	63	8	Denmark	28	8	Netherlands	47
9	Japan	62	8	Japan	28	9	China	35
10	Sweden	56	10	Sweden	22	10	Sweden	34
						10	Japan	34

Biology and Biotechnology 1998-2007			1998-2002			2003-2007		
#	Country	Co-Publications	#	Country	Co-Publications	#	Country	Co-Publications
1	USA	1829	1	USA	672	1	USA	1157
2	Australia	1330	2	Australia	473	2	Australia	857
3	UK	1104	3	UK	389	3	UK	715
4	Germany	435	4	Germany	148	4	Germany	287
5	Canada	430	5	Canada	146	5	Canada	284
6	France	294	6	Japan	86	6	France	213
7	Japan	217	7	France	81	7	China	150
8	China	190	8	Sweden	57	8	Japan	131
9	Sweden	176	9	Netherlands	54	9	Sweden	119
10	Netherlands	171	10	Switzerland	44	10	Netherlands	117

Chemistry 1998-2007			1998-2002			2003-2007		
#	Country	Co-Publications	#	Country	Co-Publications	#	Country	Co-Publications
1	USA	554	1	USA	272	1	USA	282
2	Australia	374	2	Australia	187	2	Australia	187
3	Germany	158	3	UK	119	3	England	131
4	England	131	4	Japan	76	4	Germany	92
5	Japan	130	5	Germany	66	5	Japan	54
6	UK	119	6	Canada	40	6	China	52
7	Canada	82	7	Sweden	34	7	France	42
8	France	67	8	Singapore	27	7	Canada	42
9	China	66	9	France	25	9	Singapore	31
10	Sweden	60	10	Russia	14	10	Scotland	26
			10	China	14	10	Sweden	26

Energy 1998-2007			1998-2002			2003-2007		
#	Country	Co-Publications	#	Country	Co-Publications	#	Country	Co-Publications
1	USA	48	1	USA	21	1	USA	27
2	Australia	39	2	Australia	19	2	Australia	20
3	UK	25	3	UK	16	3	UK	9
4	Germany	20	4	Germany	12	4	Germany	8
5	Canada	14	5	Canada	8	4	Japan	8
6	Japan	11	6	India	6	6	Canada	6
7	France	6	7	France	5	6	South Korea	6
7	India	6	8	Belgium	4	8	Switzerland	4
7	South Korea	6	9	Japan	3	9	Italy	3
10	Italy	5	9	Jordan	3	9	Denmark	3

Geoscience 1998-2007			1998-2002			2003-2007		
#	Country	Co-Publications	#	Country	Co-Publications	#	Country	Co-Publications
1	USA	1368	1	USA	526	1	USA	842
2	Australia	874	2	Australia	356	2	Australia	518
3	UK	810	3	UK	303	3	UK	507
4	Canada	377	4	Canada	166	4	Canada	211
5	Germany	305	5	Germany	119	5	Germany	186
6	Japan	220	6	Japan	95	6	Japan	125
7	France	187	7	France	77	7	France	110
8	China	112	8	Netherlands	46	8	China	86
9	Denmark	109	9	Denmark	30	9	Denmark	79
10	Netherlands	100	10	South Africa	28	10	Switzerland	75

Information Science and Computer Science								
1998-2007			1998-2002			2003-2007		
#	Country	Co-Publications	#	Country	Co-Publications	#	Country	Co-Publications
1	USA	195	1	USA	65	1	USA	130
2	UK	134	2	Australia	45	2	UK	100
3	Germany	104	3	UK	34	3	Germany	88
4	Australia	102	4	Canada	27	4	Australia	57
5	Canada	73	5	Germany	16	5	Canada	46
6	China	41	6	Singapore	10	6	China	31
7	Singapore	37	6	China	10	7	Singapore	27
8	Japan	29	8	Japan	8	8	Japan	21
9	South Korea	20	9	Austria	7	9	South Korea	17
10	France	19	9	Sweden	7	10	France	15

Engineering Science								
1998-2007			1998-2002			2003-2007		
#	Country	Co-Publications	#	Country	Co-Publications	#	Country	Co-Publications
1	USA	392	1	USA	148	1	USA	244
2	UK	310	2	UK	107	2	UK	203
3	Australia	242	3	Australia	82	3	Australia	160
4	China	124	4	China	65	4	Canada	76
5	Canada	120	5	Canada	44	5	Germany	65
6	Germany	101	6	Germany	36	6	China	59
7	Singapore	65	7	Singapore	27	7	Singapore	38
8	Japan	60	8	Japan	26	8	Japan	34
9	Sweden	34	9	France	13	9	South Korea	28
10	France	33	10	India	11	10	Sweden	26

Materials Science								
1998-2007			1998-2002			2003-2007		
#	Country	Co-Publications	#	Country	Co-Publications	#	Country	Co-Publications
1	USA	153	1	USA	63	1	USA	90
2	Australia	131	2	Australia	43	2	Australia	88
3	UK	114	3	UK	41	3	UK	73
4	China	88	4	Japan	39	4	China	57
5	Japan	65	5	China	31	5	Germany	40
6	Germany	60	6	Germany	20	6	Japan	26
7	Canada	32	7	Canada	19	7	South Korea	19
8	South Korea	31	8	South Korea	12	8	Poland	16
9	France	26	8	Singapore	12	8	France	16
10	Sweden	19	10	Mongol Peo Rep	10	10	Canada	13
			10	Sweden	10			
			10	France	10			

Mathematics

1998-2007			1998-2002			2003-2007		
#	Country	Co-Publications	#	Country	Co-Publications	#	Country	Co-Publications
1	USA	346	1	USA	148	1	USA	346
2	UK	184	2	Australia	77	2	UK	184
3	Australia	159	3	UK	66	3	Australia	159
4	Canada	117	4	Canada	57	4	Canada	117
5	Germany	74	5	Germany	25	5	Germany	74
6	China	44	6	Japan	23	6	China	44
7	Japan	37	7	China	16	7	Japan	37
8	Singapore	33	8	Spain	12	8	Singapore	33
9	Spain	24	8	Singapore	12	9	Spain	24
10	France	23	10	Austria	10	10	France	23
10	Netherlands	23	10	Sweden	10	10	Netherlands	23

Medicine

1998-2007			1998-2002			2003-2007		
#	Country	Co-Publications	#	Country	Co-Publications	#	Country	Co-Publications
1	USA	2961	1	USA	1181	1	USA	1780
2	Australia	2619	2	Australia	949	2	Australia	1670
3	UK	2380	3	UK	844	3	UK	1536
4	Canada	770	4	Canada	265	4	Canada	505
5	Germany	570	5	Germany	209	5	Germany	361
6	France	409	6	Netherlands	131	6	France	285
7	Netherlands	403	7	France	124	7	Netherlands	272
8	Italy	381	8	Japan	122	8	Italy	266
9	Japan	289	9	Italy	115	9	China	183
10	Switzerland	271	10	Sweden	110	10	Belgium	171

Multidisciplinary Journals

1998-2007			1998-2002			2003-2007		
#	Country	Co-Publications	#	Country	Co-Publications	#	Country	Co-Publications
1	USA	153	1	USA	57	1	USA	96
2	UK	111	2	UK	34	2	UK	77
3	Australia	65	3	Australia	14	3	Australia	51
4	Canada	36	4	Germany	11	4	Canada	29
5	Germany	34	5	Japan	7	5	Germany	23
6	Japan	24	5	France	7	6	Sweden	19
7	France	22	5	Canada	7	7	Japan	17
7	Sweden	22	8	South Africa	6	8	France	15
9	China	14	9	Italy	5	9	Denmark	11
9	Switzerland	14	9	China	5	10	Switzerland	10

Nanotechnology 1998-2007			1998-2002			2003-2007		
#	Country	Co-Publications	#	Country	Co-Publications	#	Country	Co-Publications
1	China	17	1	UK	6	1	Australia	16
2	Australia	16	1	Germany	6	2	China	13
3	UK	15	3	Japan	5	3	UK	9
4	Germany	11	4	China	4	4	USA	7
5	Japan	9	4	Canada	4	5	Germany	5
5	USA	9	6	Netherlands	3	6	Japan	4
7	Canada	4	7	USA	2	6	France	4
7	France	4	7	Singapore	2			
7	Netherlands	4	7	Italy	2			
10	Singapore	3						

Physics 1998-2007			1998-2002			2003-2007		
#	Country	Co-Publications	#	Country	Co-Publications	#	Country	Co-Publications
1	USA	599	1	USA	265	1	USA	334
2	UK	405	2	UK	160	2	UK	245
3	Australia	305	3	Australia	139	3	Australia	166
4	Germany	268	4	Germany	118	4	Germany	150
5	France	143	5	Japan	63	5	France	90
6	Japan	126	6	France	53	6	China	63
7	China	104	7	Canada	43	6	Japan	63
8	Canada	89	8	Netherlands	42	8	Italy	48
9	South Africa	78	9	China	41	9	Spain	46
10	Netherlands	74	10	South Africa	40	9	Canada	46
						9	South Korea	46

South Korea

Agricultural Science 1998-2007			1998-2002			2003-2007		
#	Country	Co-Publications	#	Country	Co-Publications	#	Country	Co-Publications
1	USA	1101	1	USA	336	1	USA	765
2	Japan	440	2	Japan	160	2	Japan	280
3	Canada	144	3	Canada	42	3	Canada	102
4	China	116	4	China	22	4	China	94
5	UK	53	5	UK	21	5	India	40
6	India	49	6	Australia	12	6	UK	32
7	Australia	37	7	Poland	10	7	Germany	28
7	Germany	37	8	India	9	8	Australia	25
9	Netherlands	24	8	Germany	9	9	Netherlands	20
10	Israel	23	10	Sweden	7	10	Thailand	19
10	Poland	23	10	Italy	7			
			10	Nigeria	7			
			10	France	7			

Biology and Biotechnology 1998-2007			1998-2002			2003-2007		
#	Country	Co-Publications	#	Country	Co-Publications	#	Country	Co-Publications
1	USA	4496	1	USA	1655	1	USA	2841
2	Japan	1679	2	Japan	616	2	Japan	1063
3	China	491	3	UK	152	3	China	403
4	Canada	379	4	Canada	115	4	Canada	264
4	UK	379	5	Germany	112	4	Germany	264
6	Germany	376	6	China	88	6	UK	227
7	India	209	7	France	56	7	India	183
8	Australia	171	8	Australia	54	8	Australia	117
9	France	163	9	Russia	31	9	Russia	116
10	Russia	147	10	Italy	29	10	France	107

Chemistry 1998-2007			1998-2002			2003-2007		
#	Country	Co-Publications	#	Country	Co-Publications	#	Country	Co-Publications
1	USA	3600	1	USA	1256	1	USA	2344
2	Japan	1711	2	Japan	702	2	Japan	1009
3	China	790	3	China	138	3	China	652
4	India	389	4	Germany	125	4	India	345
5	Germany	349	5	France	109	5	Germany	224
6	Russia	272	6	Russia	107	6	Russia	165
7	France	269	7	Canada	104	7	UK	162
8	Canada	253	8	UK	88	8	France	160
9	UK	250	9	Australia	50	9	Canada	149
10	Australia	169	10	India	44	10	Australia	119

Energy 1998-2007			1998-2002			2003-2007		
#	Country	Co-Publications	#	Country	Co-Publications	#	Country	Co-Publications
1	USA	426	1	USA	139	1	USA	287
2	Japan	256	2	Japan	93	2	Japan	163
3	Russia	97	3	Russia	30	3	China	77
4	China	93	4	Canada	19	4	Russia	67
5	India	63	5	UK	17	5	India	54
6	Germany	57	6	China	16	6	Germany	42
7	Canada	46	7	Germany	15	7	Italy	28
8	Italy	40	8	Switzerland	14	8	Canada	27
9	UK	37	9	Italy	12	9	Australia	26
10	Switzerland	35	10	France	12	10	Taiwan	24

Geoscience 1998-2007			1998-2002			2003-2007		
#	Country	Co-Publications	#	Country	Co-Publications	#	Country	Co-Publications
1	USA	1949	1	USA	599	1	USA	1350
2	Japan	582	2	Japan	159	2	Japan	423
3	China	324	3	China	59	3	China	265
4	Canada	204	4	Canada	58	4	Canada	146
5	UK	150	5	UK	50	5	UK	100
6	Germany	124	6	Russia	45	6	Germany	92
7	Russia	116	7	Germany	32	7	India	86
8	Australia	105	8	France	28	8	Australia	78
9	India	102	9	Australia	27	9	Russia	71
10	France	94	10	India	16	10	France	66

Information Science and Computer Science 1998-2007			1998-2002			2003-2007		
#	Country	Co-Publications	#	Country	Co-Publications	#	Country	Co-Publications
1	USA	1562	1	USA	488	1	USA	1074
2	Japan	252	2	Japan	83	2	China	179
3	China	219	3	China	40	3	Japan	169
4	Canada	165	4	Canada	30	4	Canada	135
5	UK	107	5	Germany	22	5	UK	86
6	Australia	77	6	UK	21	6	Australia	63
7	Poland	71	7	Australia	14	7	Poland	59
8	Germany	67	7	Taiwan	14	8	Germany	45
9	India	48	9	Poland	12	9	India	41
10	Singapore	46	9	Israel	12	9	Singapore	41

Engineering Science 1998-2007			1998-2002			2003-2007		
#	Country	Co-Publications	#	Country	Co-Publications	#	Country	Co-Publications
1	USA	5361	1	USA	1814	1	USA	3547
2	Japan	1774	2	Japan	643	2	Japan	1131
3	China	736	3	China	184	3	China	552
4	UK	485	4	UK	165	4	UK	320
5	Canada	414	5	Canada	119	5	Canada	295
6	Russia	276	6	Russia	98	6	India	218
7	Germany	271	7	Germany	79	7	Germany	192
8	India	249	8	Australia	77	8	Russia	178
9	Australia	247	9	France	60	9	Australia	170
10	France	152	10	Taiwan	42	10	France	92

Materials Science

1998-2007			1998-2002			2003-2007		
#	Country	Co-Publications	#	Country	Co-Publications	#	Country	Co-Publications
1	USA	2618	1	USA	885	1	USA	1733
2	Japan	1670	2	Japan	634	2	Japan	1036
3	China	717	3	China	213	3	China	504
4	India	336	4	Germany	112	4	India	295
5	Germany	303	5	UK	98	5	Germany	191
6	UK	288	6	Russia	75	6	UK	190
7	Russia	261	7	France	62	7	Russia	186
8	France	151	8	Canada	52	8	Canada	90
9	Canada	142	9	Australia	46	9	France	89
10	Australia	133	10	India	41	10	Australia	87

Mathematics

1998-2007			1998-2002			2003-2007		
#	Country	Co-Publications	#	Country	Co-Publications	#	Country	Co-Publications
1	USA	1118	1	USA	469	1	USA	649
2	China	397	2	China	111	2	China	286
3	Japan	240	3	Japan	74	3	Japan	166
4	Canada	129	4	Canada	45	4	Canada	84
5	UK	100	5	Germany	35	5	UK	76
6	Germany	86	6	Australia	29	6	India	58
7	India	77	7	UK	24	7	France	53
8	France	71	8	Italy	22	8	Germany	51
9	Australia	62	9	India	19	9	Spain	39
10	Spain	58	9	Spain	19	10	Australia	33

Medicine

1998-2007			1998-2002			2003-2007		
#	Country	Co-Publications	#	Country	Co-Publications	#	Country	Co-Publications
1	USA	7691	1	USA	2614	1	USA	5077
2	Japan	2047	2	Japan	735	2	Japan	1312
3	China	761	3	Canada	195	3	China	613
4	Canada	652	4	UK	188	4	Canada	457
5	UK	590	5	China	148	5	UK	402
6	Germany	406	6	Germany	134	6	Germany	272
7	France	291	7	Sweden	69	7	France	230
8	Taiwan	289	7	Taiwan	69	8	Taiwan	220
9	Australia	249	9	France	61	9	Australia	199
10	Italy	247	10	Italy	59	10	Italy	188

Multidisciplinary Journals 1998-2007			1998-2002			2003-2007		
#	Country	Co-Publications	#	Country	Co-Publications	#	Country	Co-Publications
1	USA	292	1	USA	100	1	USA	192
2	Japan	78	2	Japan	32	2	Japan	46
3	China	41	3	China	13	3	China	28
4	Germany	33	4	Canada	10	4	Germany	24
5	UK	30	5	UK	9	5	UK	21
6	Canada	24	5	Germany	9	6	France	20
7	France	22	7	India	5	7	Canada	14
8	Australia	13	8	Australia	3	8	Sweden	11
8	India	13	8	Hungary	3	9	Italy	10
10	Italy	12	8	Russia	3	10	Australia	10

Nanotechnology 1998-2007			1998-2002			2003-2007		
#	Country	Co-Publications	#	Country	Co-Publications	#	Country	Co-Publications
1	USA	425	1	USA	111	1	USA	314
2	Japan	181	2	Japan	37	2	Japan	144
3	China	96	3	China	23	3	China	73
4	Germany	59	4	UK	14	4	Germany	46
5	UK	51	5	Germany	13	5	UK	37
6	India	37	6	Russia	10	6	India	37
7	Russia	31	7	Australia	5	7	Russia	21
8	Taiwan	23	8	Taiwan	4	8	Taiwan	19
9	Australia	21	9	Canada	3	9	Australia	16
10	Switzerland	18	9	Poland	3	10	Switzerland	16

Physics 1998-2007			1998-2002			2003-2007		
#	Country	Co-Publications	#	Country	Co-Publications	#	Country	Co-Publications
1	USA	7197	1	USA	2825	1	USA	4372
2	Japan	3311	2	Japan	1086	2	Japan	2225
3	Russia	1963	3	Russia	735	3	Russia	1228
4	Germany	1881	4	Germany	724	4	Germany	1157
5	China	1659	5	China	586	5	China	1073
6	UK	1337	6	UK	471	6	UK	866
7	France	1133	7	France	444	7	India	753
8	India	1073	8	Italy	413	8	France	689
9	Italy	964	9	Taiwan	347	9	Taiwan	616
10	Taiwan	963	10	Canada	337	10	Switzerland	605

Taiwan

Agricultural Science *1998-2007*			*1998-2002*			*2003-2007*		
#	*Land*	*Co-Publications*	*#*	*Land*	*Co-Publications*	*#*	*Land*	*Co-Publications*
1	USA	326	*1*	USA	137	*1*	USA	189
2	Japan	94	*2*	Japan	42	*2*	Japan	52
3	Canada	36	*3*	UK	19	*3*	Canada	24
4	UK	31	*4*	Canada	12	*4*	India	23
5	India	25	*5*	New Zealand	7	*5*	China	22
5	China	25	*6*	France	6	*6*	Australia	17
7	Australia	22	*6*	Philippines	6	*7*	France	12
8	France	18	*8*	Australia	5	*7*	UK	12
9	Germany	14	*9*	Germany	4	*9*	Thailand	11
9	Thailand	14	*9*	Poland	4	*10*	Germany	10
			9	South Korea	4			

Biology and Biotechnology *1998-2007*			*1998-2002*			*2003-2007*		
#	*Land*	*Co-Publications*	*#*	*Land*	*Co-Publications*	*#*	*Land*	*Co-Publications*
1	USA	2031	*1*	USA	778	*1*	USA	1253
2	Japan	514	*2*	Japan	178	*2*	Japan	336
3	China	345	*3*	China	112	*3*	China	233
4	UK	243	*4*	UK	85	*4*	UK	158
5	Canada	189	*5*	Canada	65	*5*	Canada	124
6	Germany	162	*6*	Germany	50	*6*	Germany	112
7	France	104	*7*	Australia	37	*7*	France	72
8	Singapore	101	*8*	Singapore	35	*8*	Singapore	66
9	Australia	97	*9*	France	32	*9*	Australia	60
10	India	72	*10*	South Korea	20	*10*	India	59

Chemistry 1998-2007			1998-2002			2003-2007		
#	Land	Co-Publications	#	Land	Co-Publications	#	Land	Co-Publications
1	USA	1129	1	USA	410	1	USA	719
2	China	554	2	China	177	2	China	377
3	Japan	443	3	India	120	3	Japan	324
4	India	359	4	Japan	119	4	India	239
5	Germany	190	5	Germany	88	5	Canada	107
6	Canada	164	6	Canada	57	6	Germany	102
7	UK	103	7	UK	47	7	Russia	65
8	Russia	90	8	Singapore	29	8	UK	56
9	France	77	9	Australia	27	9	France	52
10	Poland	72	10	France	25	10	Poland	47
			10	Poland	25			
			10	Russia	25			
			10	South Korea	25			

Energy 1998-2007			1998-2002			2003-2007		
#	Land	Co-Publications	#	Land	Co-Publications	#	Land	Co-Publications
1	USA	152	1	USA	51	1	USA	101
2	Japan	61	2	Switzerland	15	2	Japan	51
3	China	38	3	China	14	3	Australia	25
4	South Korea	34	4	Germany	11	4	China	24
5	Switzerland	32	5	Japan	10	4	South Korea	24
6	Australia	31	5	South Korea	10	6	India	23
7	India	29	7	Italy	8	7	Poland	19
8	Germany	26	7	Russia	8	8	Slovenia	17
9	Russia	23	9	Australia	6	8	Switzerland	17
10	Poland	22	9	India	6	10	Germany	15
						10	Russia	15
						10	UK	15

Geoscience 1998-2007			1998-2002			2003-2007		
#	Land	Co-Publications	#	Land	Co-Publications	#	Land	Co-Publications
1	USA	1323	1	USA	568	1	USA	755
2	China	307	2	Japan	89	2	China	232
3	Japan	253	3	China	75	3	Japan	164
4	France	125	4	France	54	4	UK	95
5	UK	124	5	Australia	40	5	France	71
6	Australia	107	6	UK	29	6	Germany	69
7	Germany	94	7	Canada	27	7	Australia	67
8	Canada	73	8	Germany	25	8	Canada	46
9	Singapore	43	9	Russia	13	9	South Korea	32
10	South Korea	42	10	Singapore	12	10	Singapore	31

Information Science and Computer Science 1998-2007			1998-2002			2003-2007		
#	Land	Co-Publications	#	Land	Co-Publications	#	Land	Co-Publications
1	USA	910	1	USA	374	1	USA	536
2	China	193	2	China	38	2	China	155
3	Japan	98	3	Canada	36	3	Japan	70
4	Canada	79	4	Japan	28	4	UK	55
5	UK	72	5	Australia	23	5	Canada	43
6	Australia	60	6	UK	17	6	Australia	37
7	South Korea	44	7	South Korea	14	7	South Korea	30
8	Singapore	35	8	Hong Kong	12	8	Singapore	26
9	Germany	29	9	Germany	9	9	Germany	20
10	France	16	9	Singapore	9	10	France	9

Engineering Science 1998-2007			1998-2002			2003-2007		
#	Land	Co-Publications	#	Land	Co-Publications	#	Land	Co-Publications
1	USA	2423	1	USA	1030	1	USA	1393
2	China	473	2	China	126	2	China	347
3	Japan	427	3	Japan	117	3	Japan	310
4	UK	197	4	UK	60	4	UK	137
5	Canada	178	5	Canada	53	5	Canada	125
6	Singapore	153	6	Australia	50	6	Singapore	121
7	Germany	141	7	Germany	45	7	Germany	96
8	Australia	137	8	South Korea	42	8	Australia	87
9	South Korea	119	9	Singapore	32	9	South Korea	77
10	India	93	10	France	24	10	India	71

Materials Science

1998-2007			1998-2002			2003-2007		
#	Land	Co-Publications	#	Land	Co-Publications	#	Land	Co-Publications
1	USA	741	1	USA	292	1	USA	449
2	Japan	278	2	Japan	79	2	China	204
3	China	275	3	China	71	3	Japan	199
4	India	208	4	India	70	4	India	138
5	Germany	91	5	UK	31	5	Germany	69
6	Canada	89	6	Canada	22	6	Canada	67
7	UK	76	6	Germany	22	7	South Korea	48
8	South Korea	60	8	Singapore	14	8	UK	45
9	Singapore	52	9	France	13	9	Singapore	38
10	Russia	45	10	South Korea	12	10	Russia	35

Mathematics

1998-2007			1998-2002			2003-2007		
#	Land	Co-Publications	#	Land	Co-Publications	#	Land	Co-Publications
1	USA	857	1	USA	406	1	USA	451
2	China	347	2	China	94	2	China	253
3	Canada	120	3	Canada	45	3	Japan	86
4	Japan	118	4	Japan	32	4	Canada	75
5	Australia	68	5	Russia	30	5	Australia	42
6	Russia	66	6	Australia	26	6	Russia	36
7	Germany	54	7	Singapore	24	7	Germany	33
8	India	45	8	India	22	8	UK	24
9	Singapore	43	9	Germany	21	9	India	23
10	UK	42	10	UK	18	10	Singapore	19

Medicine

1998-2007			1998-2002			2003-2007		
#	Land	Co-Publications	#	Land	Co-Publications	#	Land	Co-Publications
1	USA	4944	1	USA	1776	1	USA	3168
2	Japan	906	2	Japan	324	2	Japan	582
3	UK	638	3	UK	202	3	China	444
4	China	623	4	China	179	4	UK	436
5	Canada	383	5	Canada	154	5	Australia	231
6	Australia	342	6	Australia	111	6	Canada	229
7	South Korea	289	7	Singapore	83	7	South Korea	220
8	France	282	8	France	76	8	Germany	208
9	Germany	281	9	Germany	73	9	France	206
10	Singapore	274	10	South Korea	69	10	Singapore	191

Multidisciplinary Journals

1998-2007			1998-2002			2003-2007		
#	Land	Co-Publications	#	Land	Co-Publications	#	Land	Co-Publications
1	USA	181	1	USA	69	1	USA	112
2	China	64	2	China	27	2	China	37
3	Japan	33	3	UK	9	3	Japan	24
4	UK	31	3	Germany	9	4	UK	22
5	Germany	21	3	Japan	9	5	Canada	17
6	Canada	20	6	Canada	3	6	France	12
7	France	15	6	France	3	6	Germany	12
8	Australia	13	6	Israel	3	8	Australia	11
9	India	10	6	Mexico	3	9	Italy	9
10	Italy	9				10	India	8

Nanotechnology

1998-2007			1998-2002			2003-2007		
#	Land	Co-Publications	#	Land	Co-Publications	#	Land	Co-Publications
1	USA	152	1	USA	45	1	USA	107
2	Japan	54	2	Japan	9	2	Japan	45
3	China	29	3	China	8	3	China	21
4	UK	25	4	UK	6	4	South Korea	19
5	South Korea	23	5	Czech Republic	4	4	UK	19
6	Australia	18	5	South Korea	4	6	Australia	16
7	Germany	15	7	Germany	3	7	Germany	12
8	India	12	8	Australia	2	8	India	11
9	Russia	11	8	Russia	2	9	Canada	10
10	Canada	10	8	Ukraine	2	10	France	9
							Russia	9

Physics

1998-2007			1998-2002			2003-2007		
#	Land	Co-Publications	#	Land	Co-Publications	#	Land	Co-Publications
1	USA	3546	1	USA	1453	1	USA	2093
2	Japan	1419	2	China	482	2	Japan	1009
3	China	1408	3	Germany	457	3	China	926
4	Germany	1030	4	Japan	410	4	Russia	637
5	Russia	1003	5	Russia	366	5	South Korea	617
6	South Korea	964	6	South Korea	347	6	Germany	573
7	India	742	7	Switzerland	295	7	India	499
8	Switzerland	728	8	Italy	269	8	Switzerland	433
9	Canada	552	9	India	243	9	Canada	336
10	UK	535	10	Canada	216	10	UK	325

3. Citation Analysis

3.1 Citation Rates for the Countries Studied over the Entire Period

The perception of scientific publications can be measured using citations by other scientists in the form of the average number of citations per article (citation rate). In the sciences, the Science Citation Index (SCI) is used most often as the data source for this purpose. SCI consists predominantly of internationally respected journal articles and simultaneously records their citations in the journals evaluated. The citation rate is an indicator that is independent of the size of an institution or country but not of the size of the individual discipline. This means that the citation rate is not suitable for interdisciplinary comparisons.

Figures 57 to 60 show the average citation rate (entire period) for each country studied in each of the disciplines presented. The perception of different countries can be compared within a discipline. To provide a better overview, the disciplines are split into two groups and presented in two charts, as are the countries. This results in four spider charts. We can see, for example, that China is ranked quite poorly in almost all of the disciplines investigated despite a high number of publications. It is also obvious that Australia's perception is as high as Germany's in many disciplines despite the fact that its publication output is significantly lower.

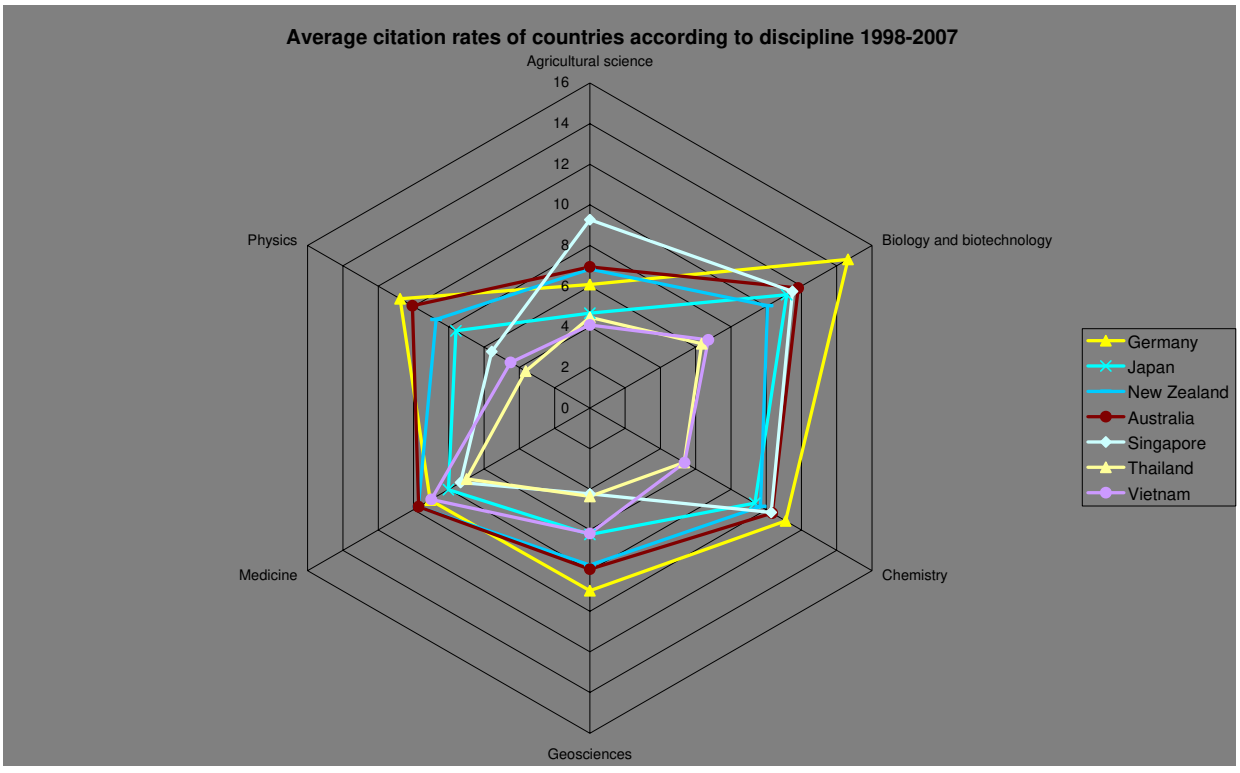

Figure 57: Average citation rates for Germany, Japan, New Zealand, Australia, Singapore, Thailand and Vietnam in agricultural science, biology and biotechnology, chemistry, geosciences, medicine and physics

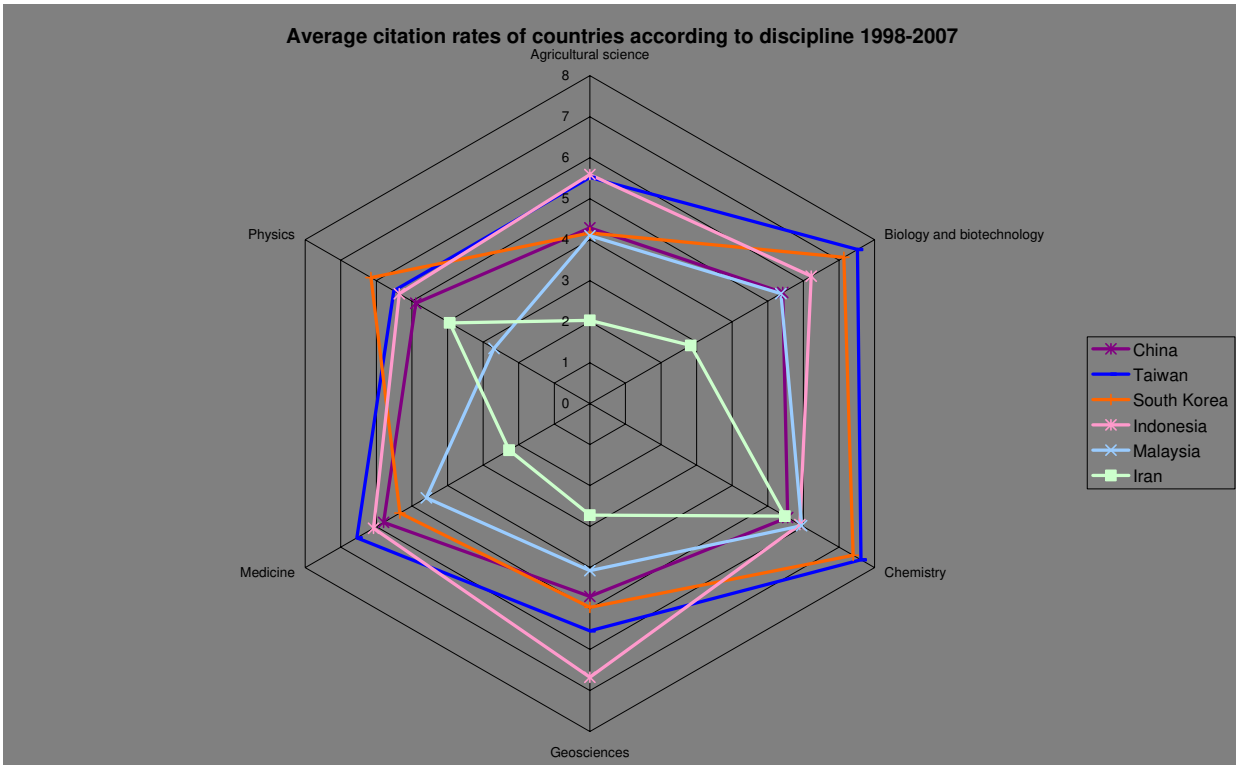

Figure 58: Average citation rates for China, Taiwan, South Korea, Indonesia, Malaysia and Iran in agricultural science, biology and biotechnology, chemistry, geosciences, medicine and physics

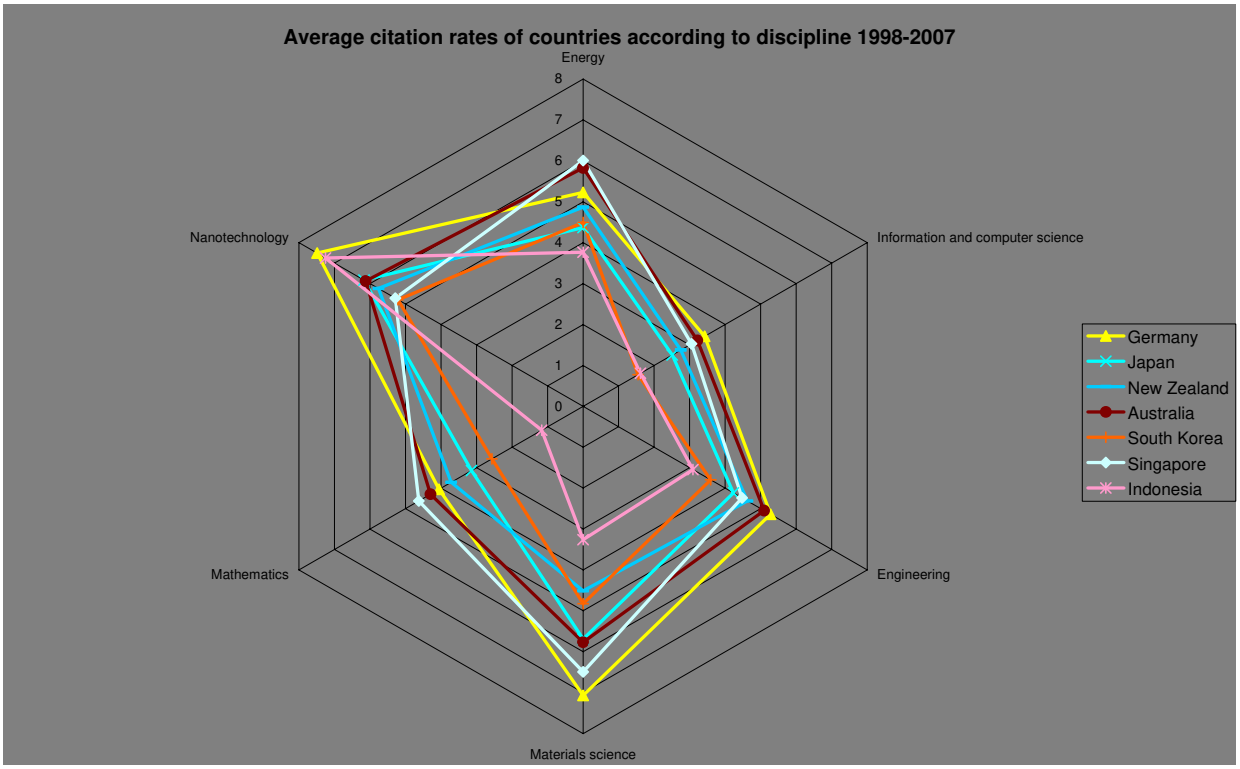

Figure 59: Average citation rates for Germany, Japan, New Zealand, Australia, South Korea, Singapore, and Indonesia in energy, information and computer science, engineering, materials science, mathematics and nanotechnology

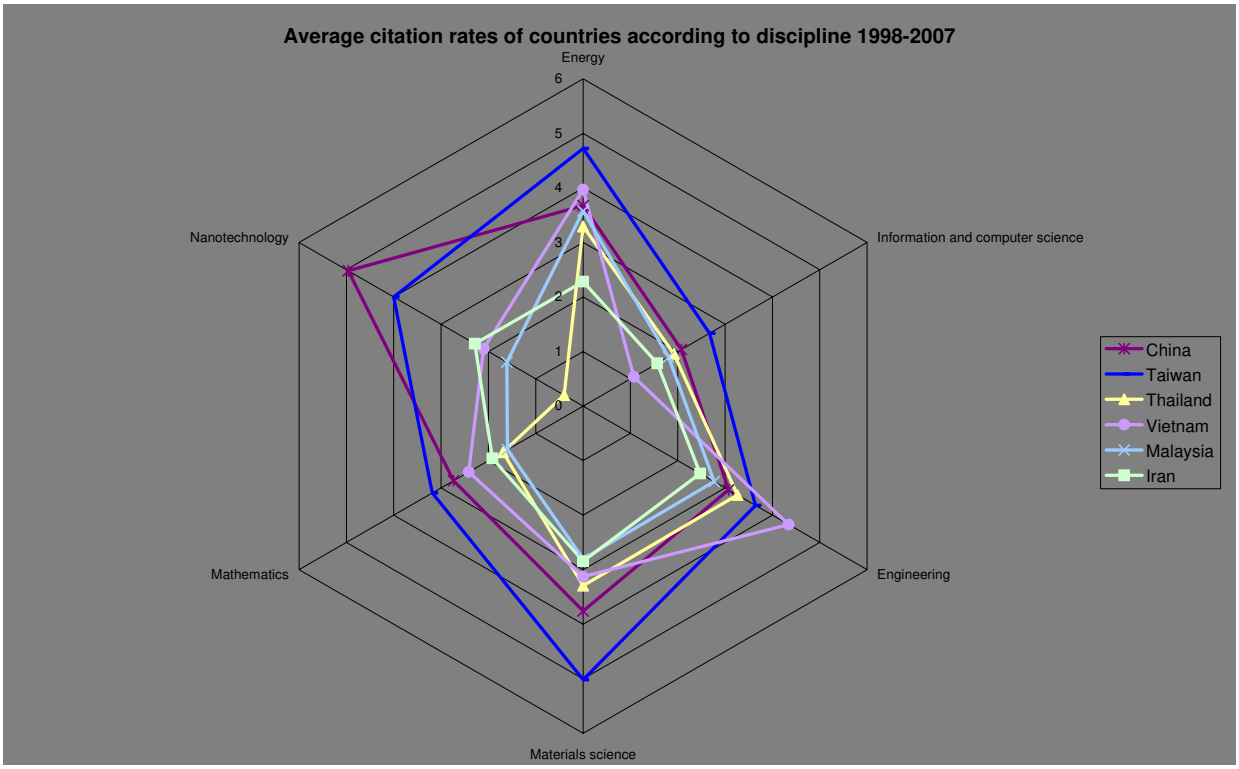

Figure 60: Average citation rates for China, Taiwan, Thailand, Vietnam, Malaysia and Iran in energy, information and computer science, engineering, materials science, mathematics and nanotechnology

The spider charts that follow (Figures 61 to 63) present citation rates (entire period) in a similar manner to Figures 57 – 60 with the difference that the countries are depicted on the axes and the disciplines are represented by curves in each of the charts. This makes it possible to illustrate all of the countries that publish in a discipline in the one chart, which in turn allows us to determine the country with the strongest perception in each of the disciplines. For example, the citation rate of Singapore in mathematics is above that of Germany. The same is true for publications in medicine from New Zealand.

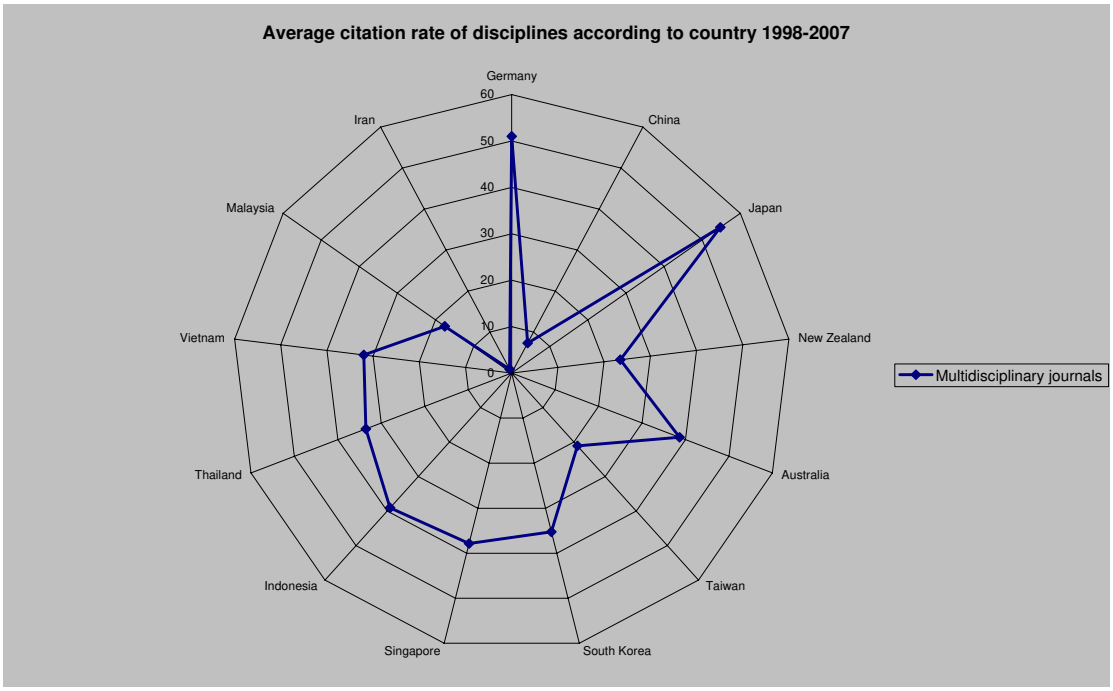

Figure 61: Average citation rate of the countries studied in the category “multidisciplinary journals”

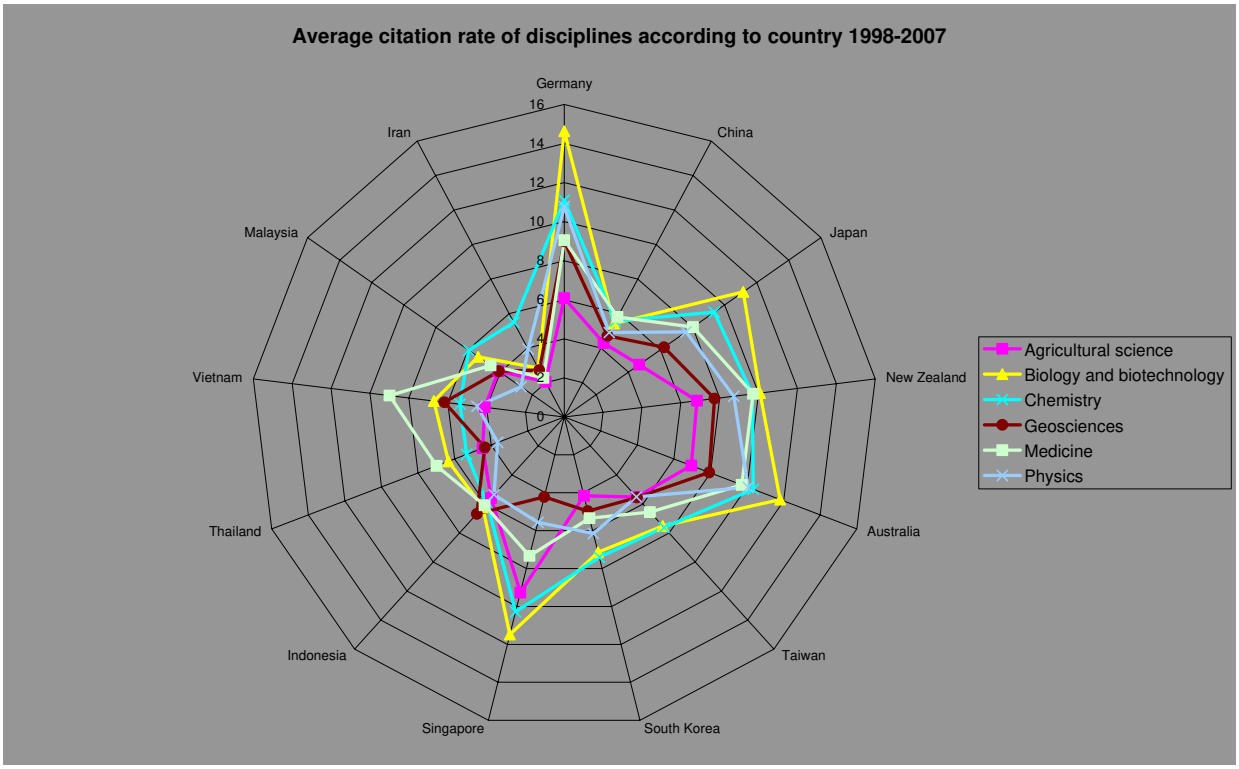

Figure 62: Average citation rate of the countries studied in agricultural science, biology and biotechnology, chemistry, geosciences, medicine and physics

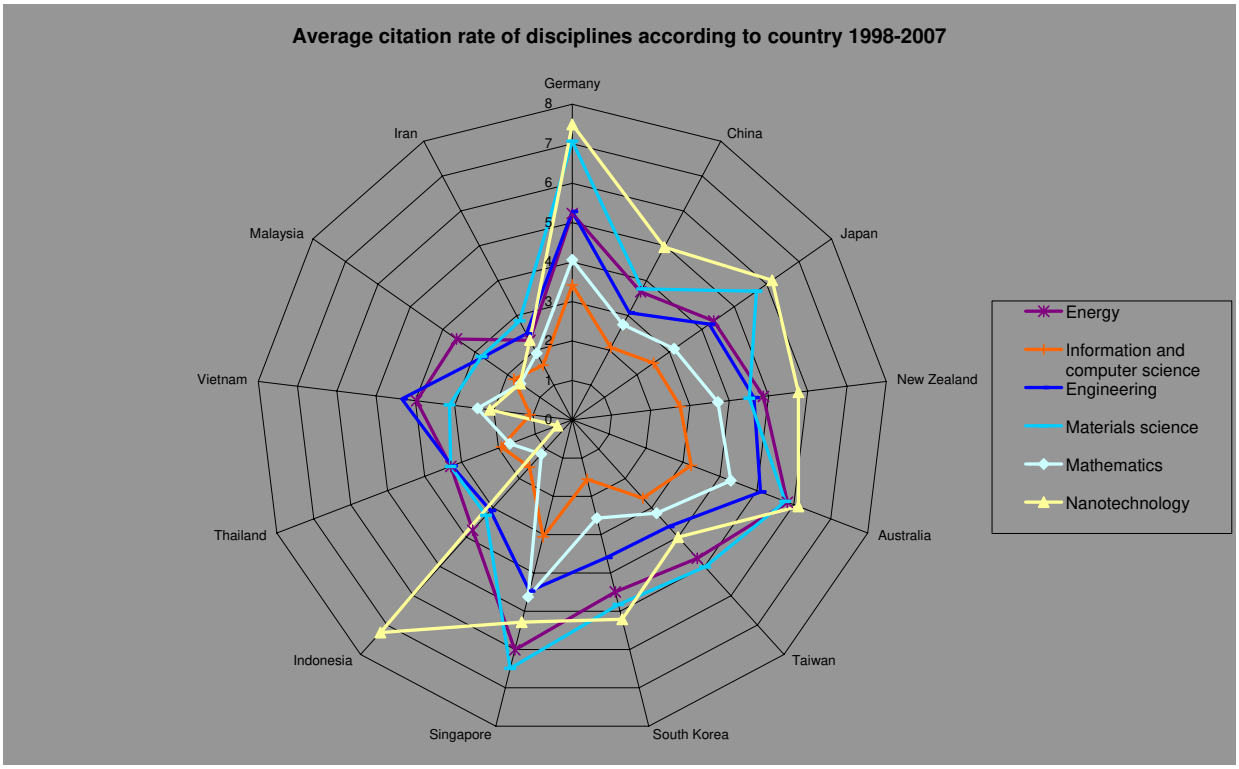

Figure 63: Average citation rate of the countries studied in energy, information and computer science, engineering, materials science, mathematics and nanotechnology

3.2 Citation Rates for the Countries Studied over Time

The graphs that follow show the citation rates of each country in each discipline over time. This allows us to determine shifts in the perception of individual countries that may have occurred during the ten-year period under review. The further back the date of publication of an article is, the better its chances are of being perceived, in other words of being cited. Citation rates for more current articles are generally much lower than those for older publications.

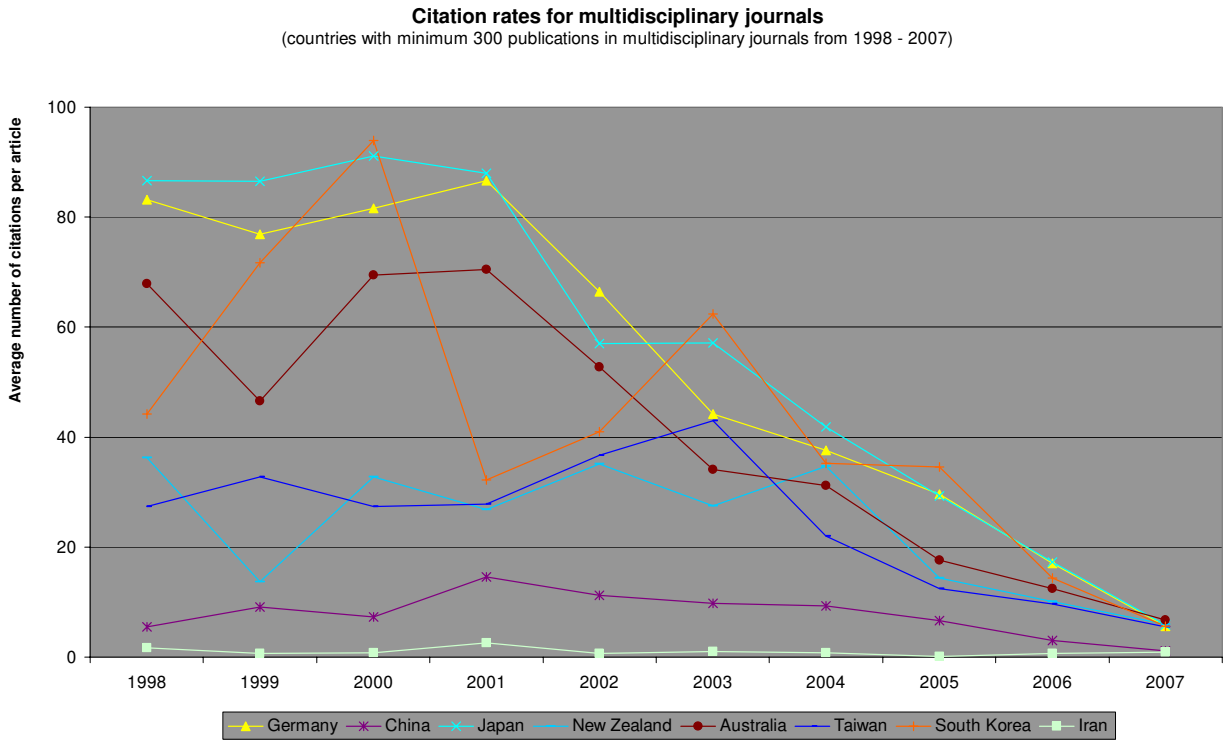

Figure 64: Citation rates for the subject category “multidisciplinary journals” over time

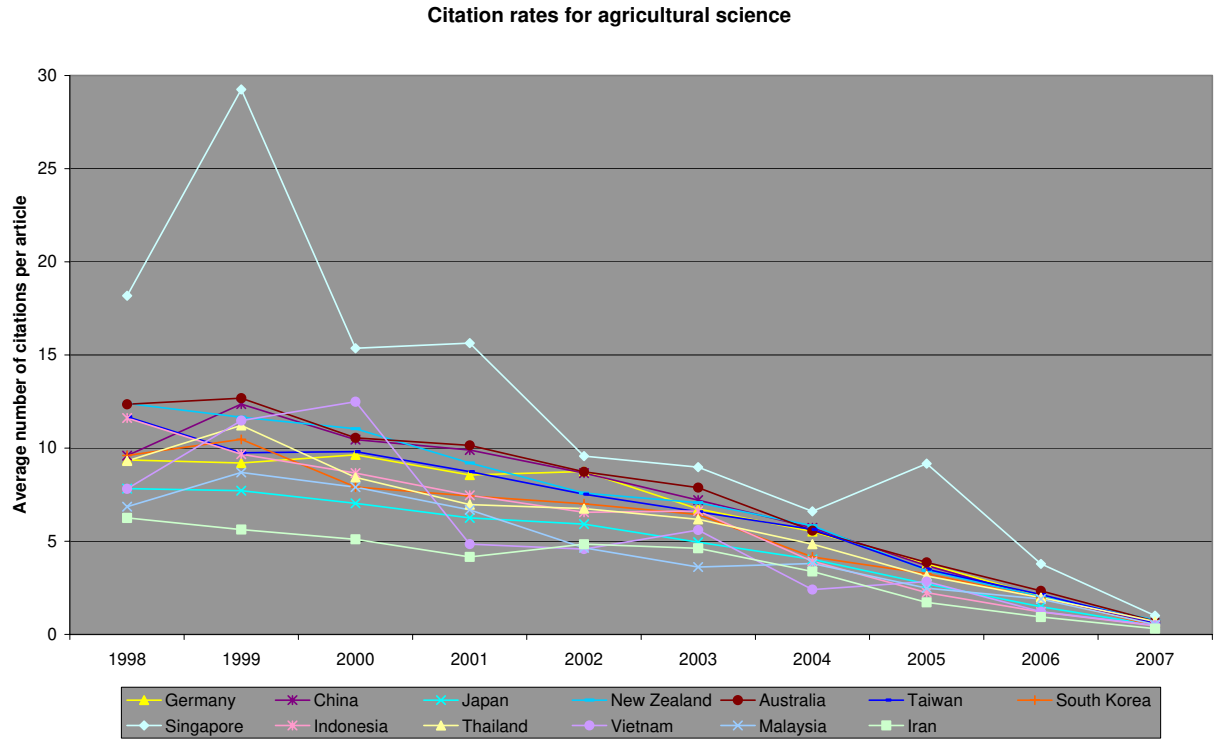

Figure 65: Citation rates for the subject category “agricultural science” over time

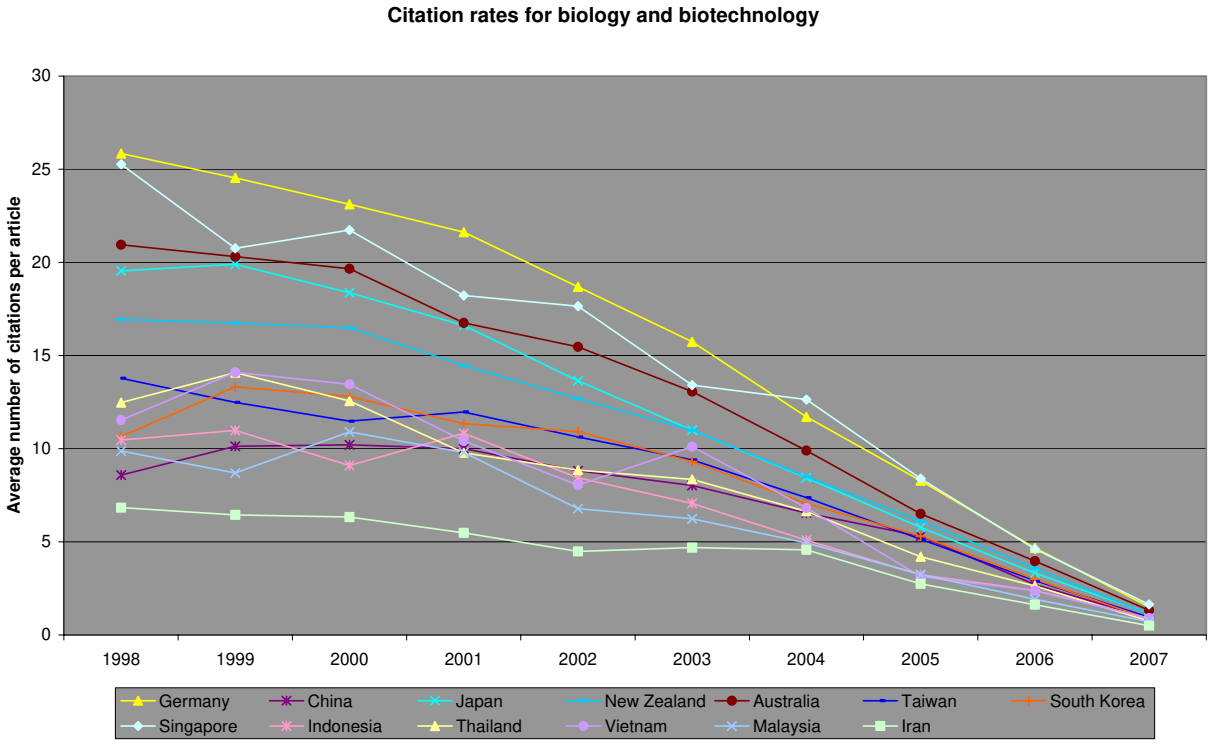

Figure 66: Citation rates for the subject category “biology and biotechnology” over time

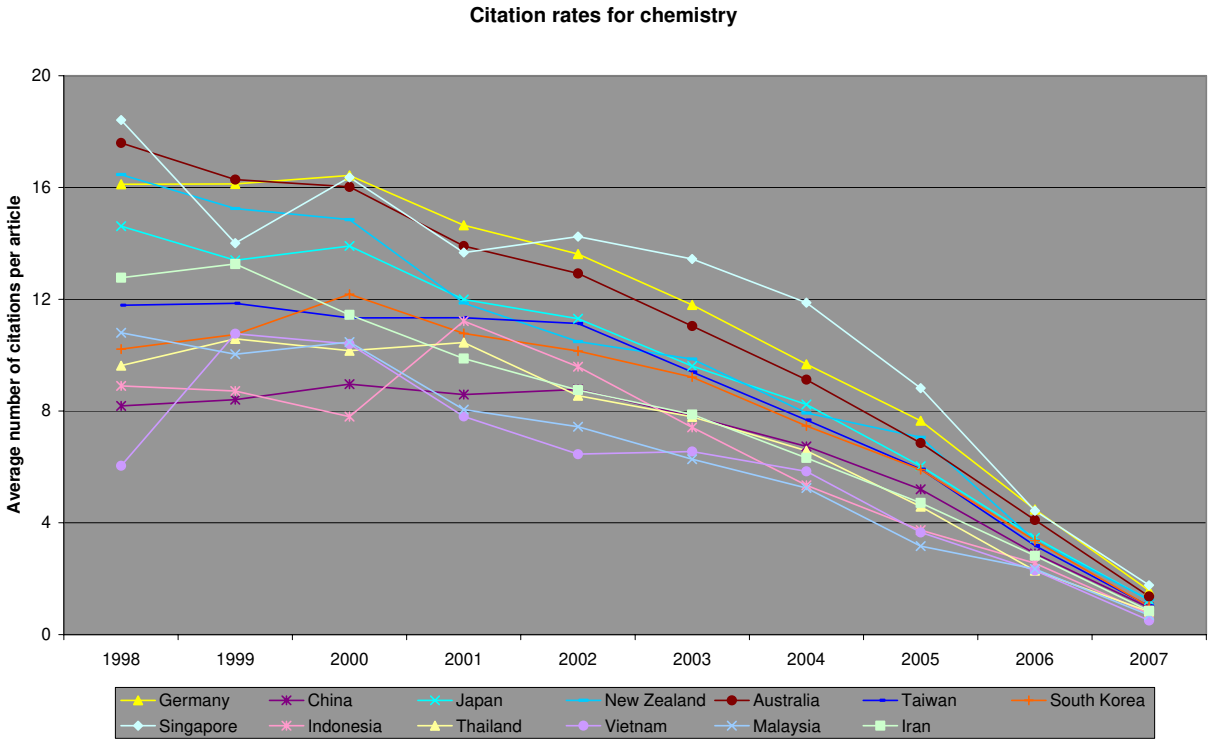

Figure 67: Citation rates for the subject category “chemistry” over time

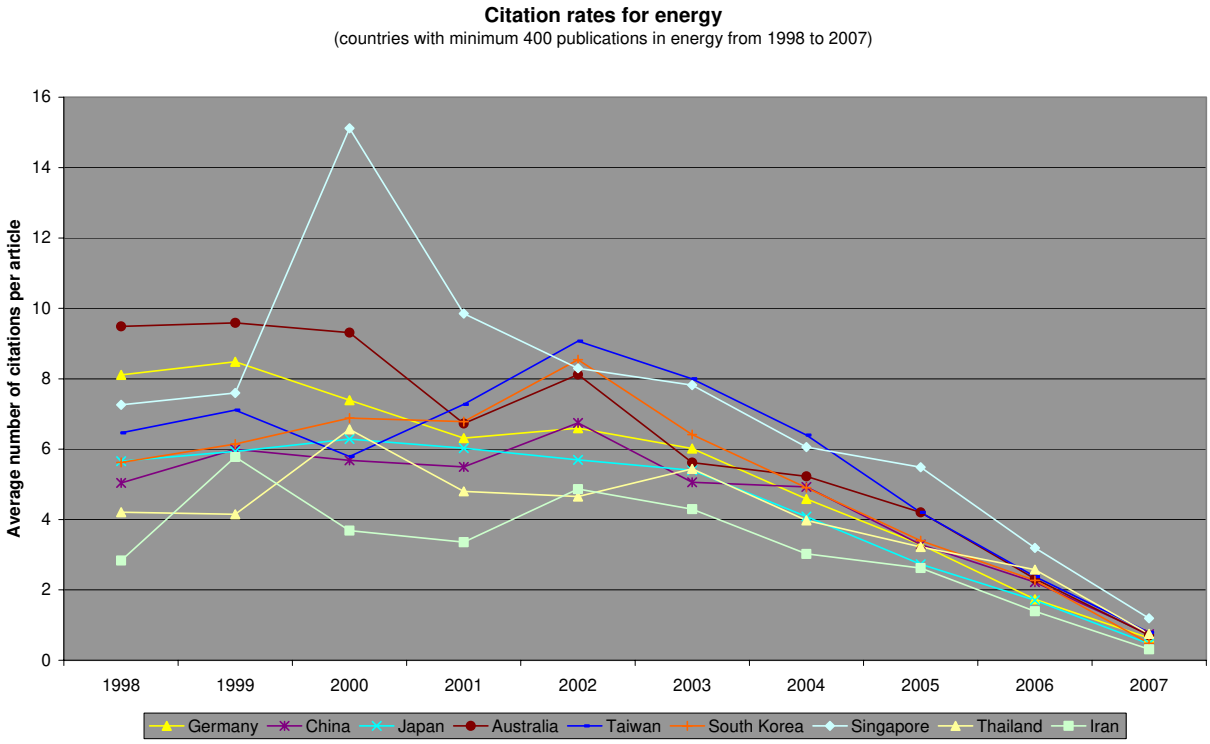

Figure 68: Citation rates for the subject category “energy” over time

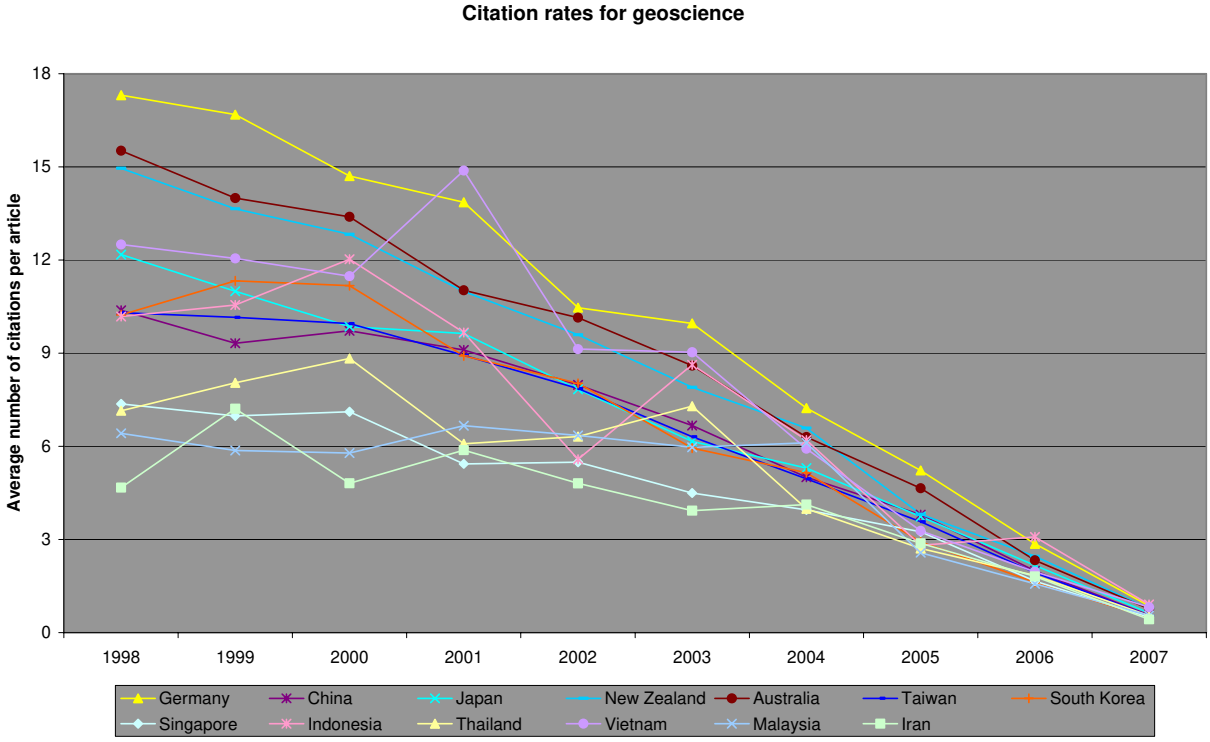

Figure 69: Citation rates for the subject category “geosciences” over time

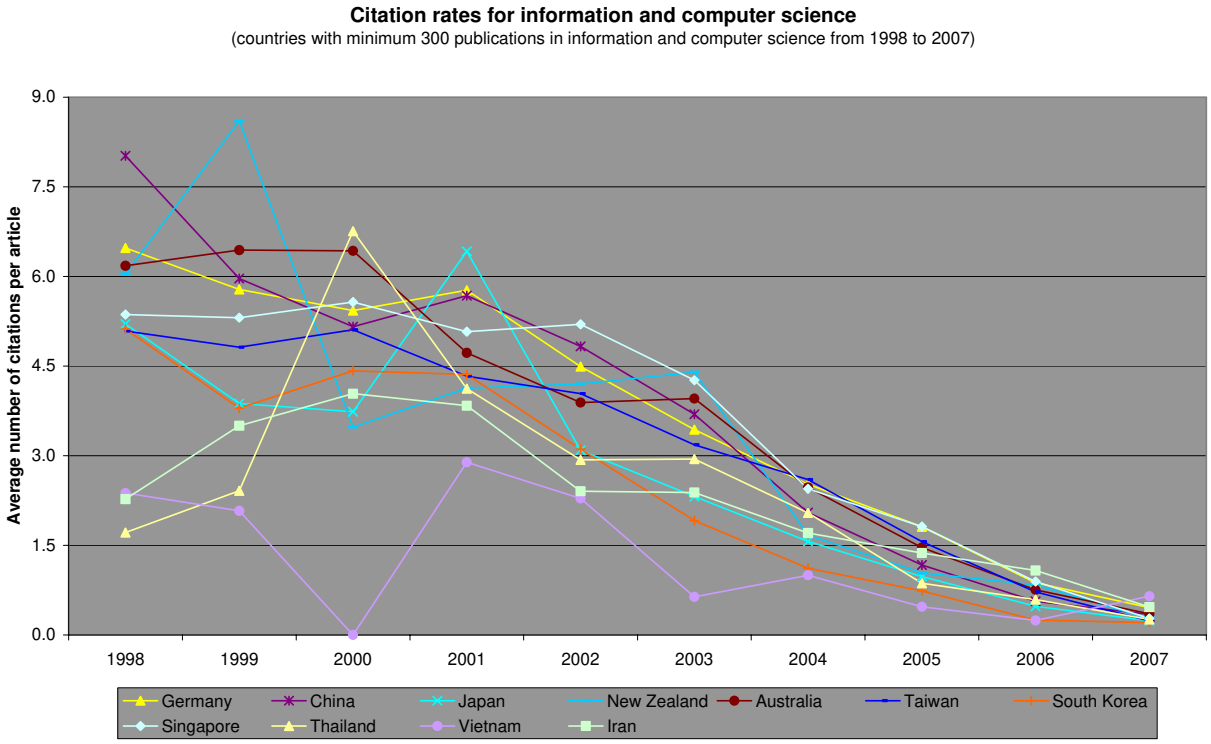

Figure 70: Citation rates for the subject category “information and computer science” over time

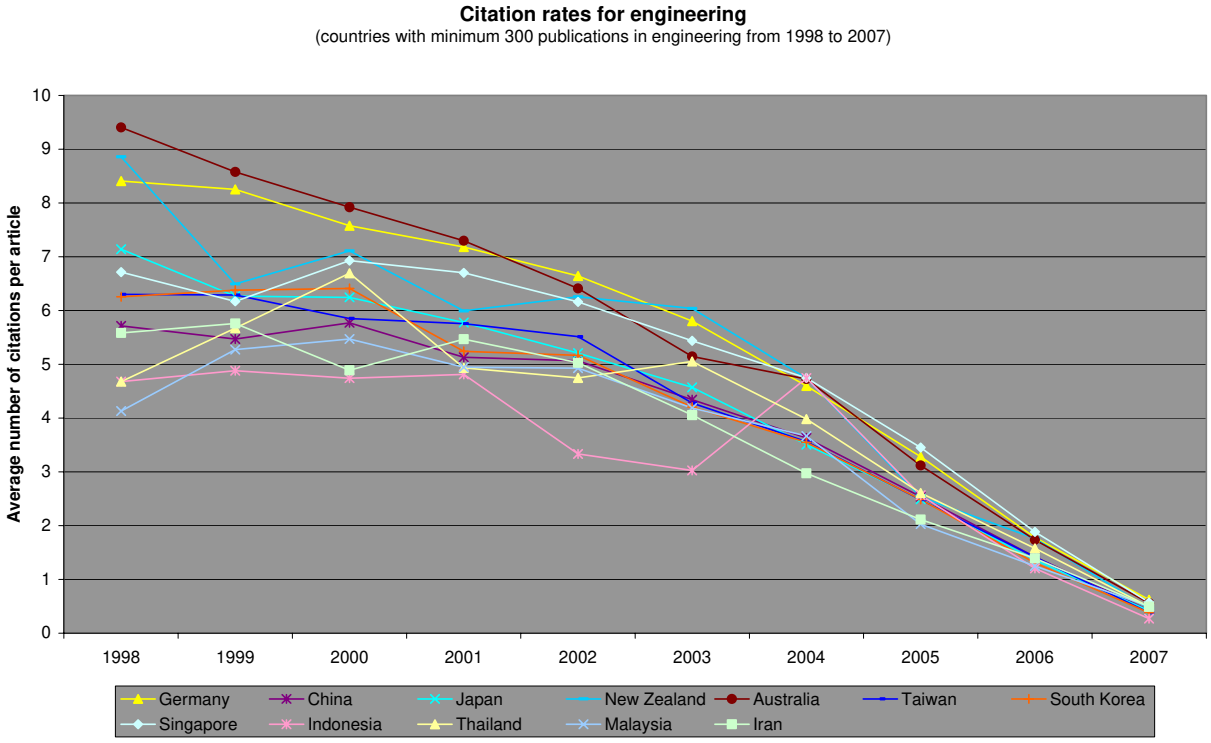

Figure 71: Citation rates for the subject category “engineering” over time

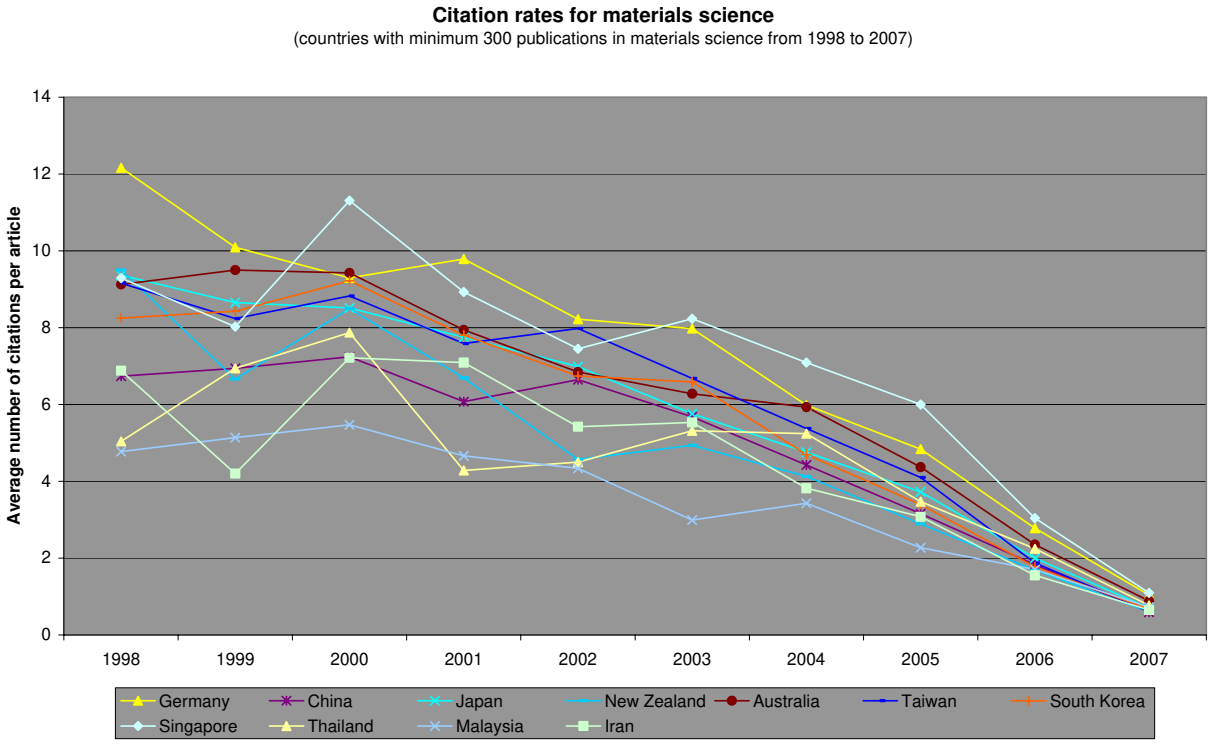

Figure 72: Citation rates for the subject category “materials science” over time

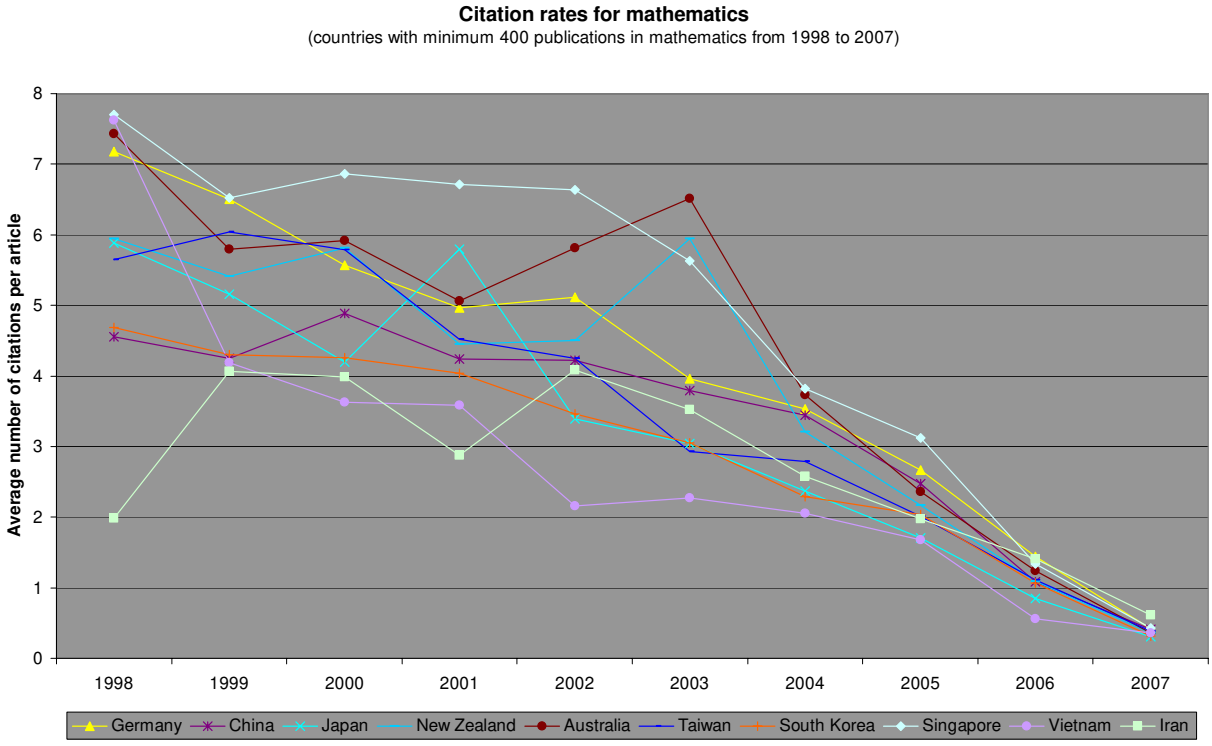

Figure 73: Citation rates for the subject category “mathematics” over time

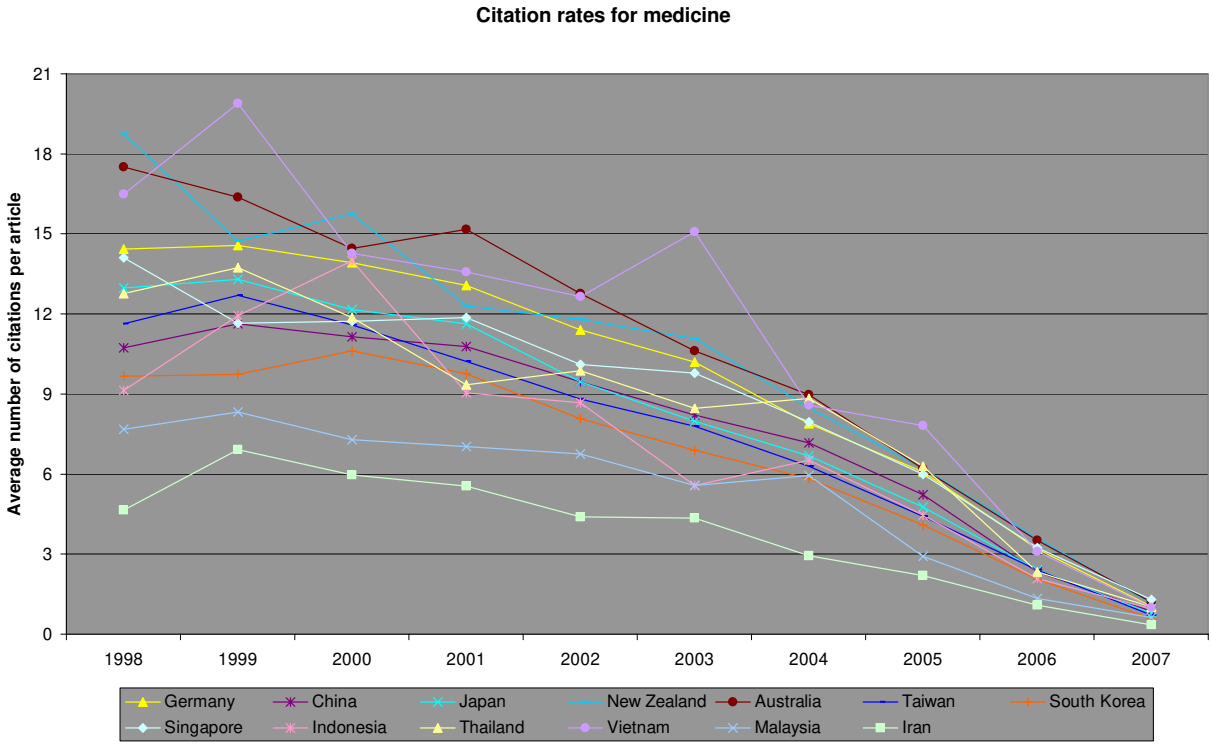

Figure 74: Citation rates for the subject category “medicine” over time

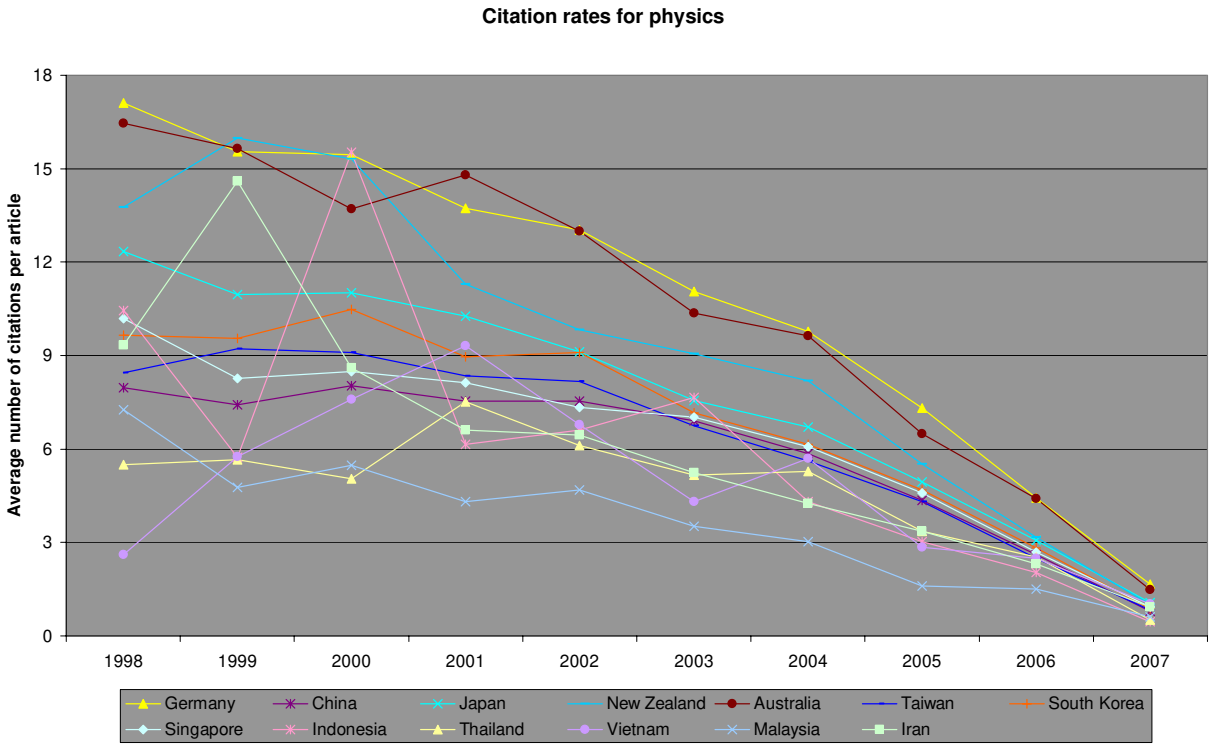

Figure 75: Citation rates for the subject category “physics” over time

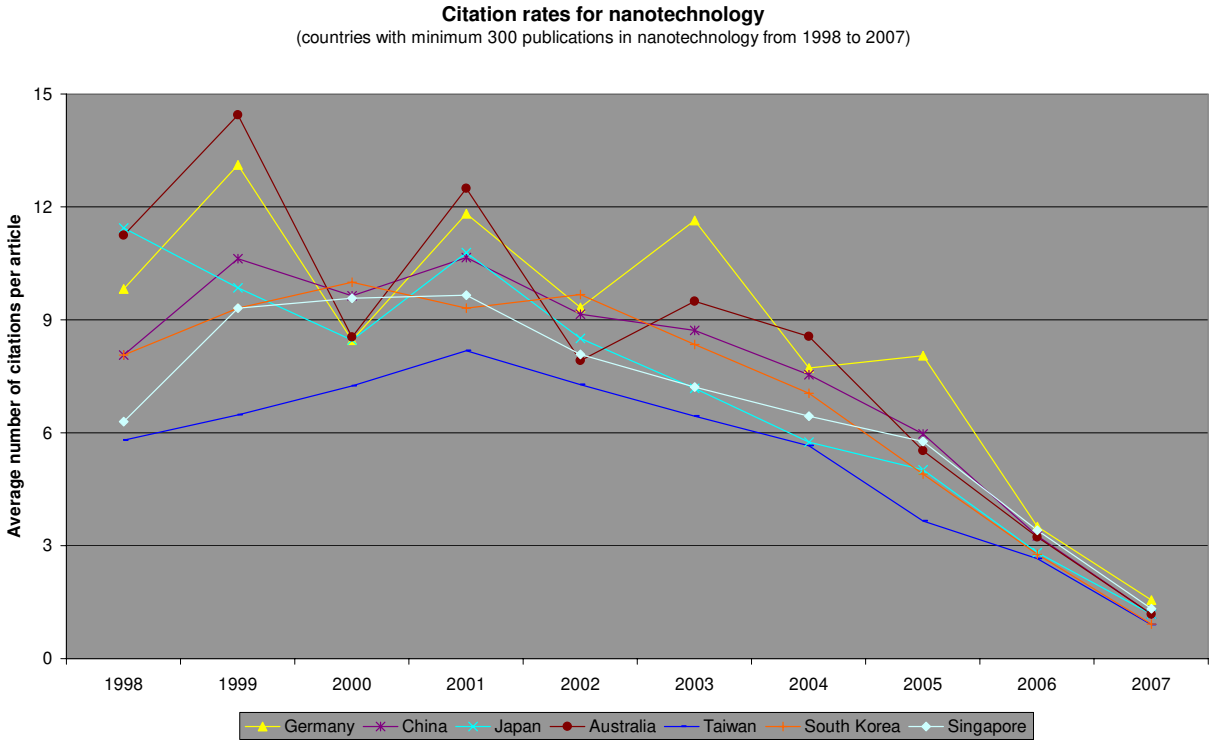

Figure 76: Citation rates for the subject category “nanotechnology” over time

The graphs that follow show the citation rates of the disciplines over time grouped according to each country studied. This allows us to draw conclusions on the perception of countries in the disciplines and to compare the impact of a discipline in the respective countries. Relatively small numbers in the publication output are partially responsible for significant shifts. It can also be seen, for example, that Iranian publications in multidisciplinary journals are only perceived to a very limited degree and that the citation rate for this subject category is the worst of all of the Iranian citation rates. In contrast to this, this subject category is top of the list for all of the other countries analysed and at times must be placed on a secondary axis.

A drop in the citation rates as we approach the present is not unusual because newer publications have had less time to be read and then cited in other subsequent publications.

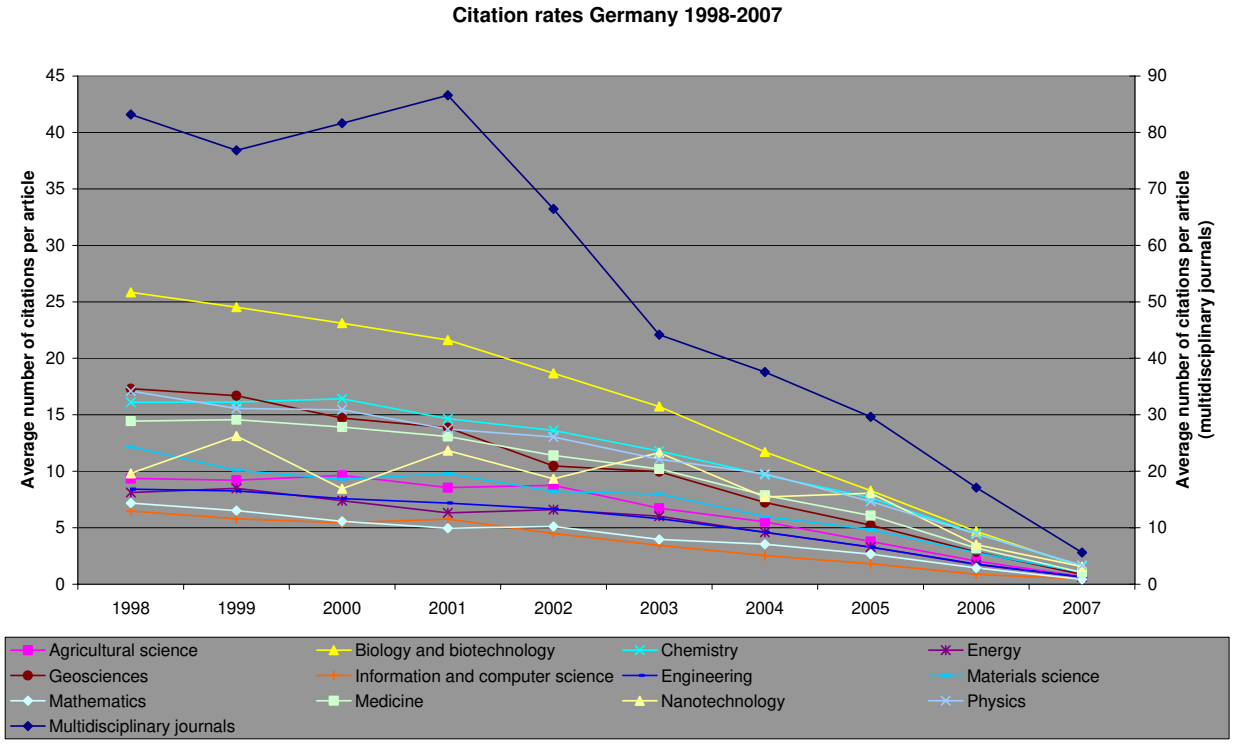

Figure 77: Citation rates for the disciplines studied (Germany)

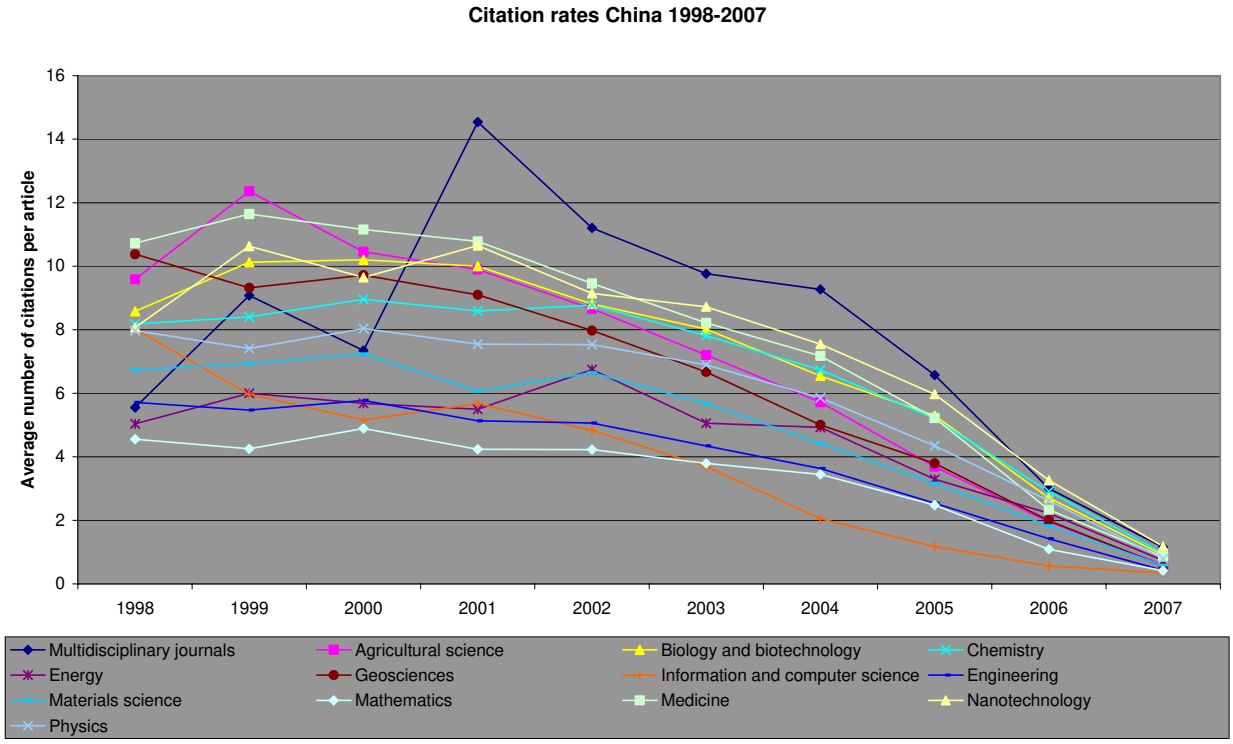

Figure 78: Citation rates for the disciplines studied (China)

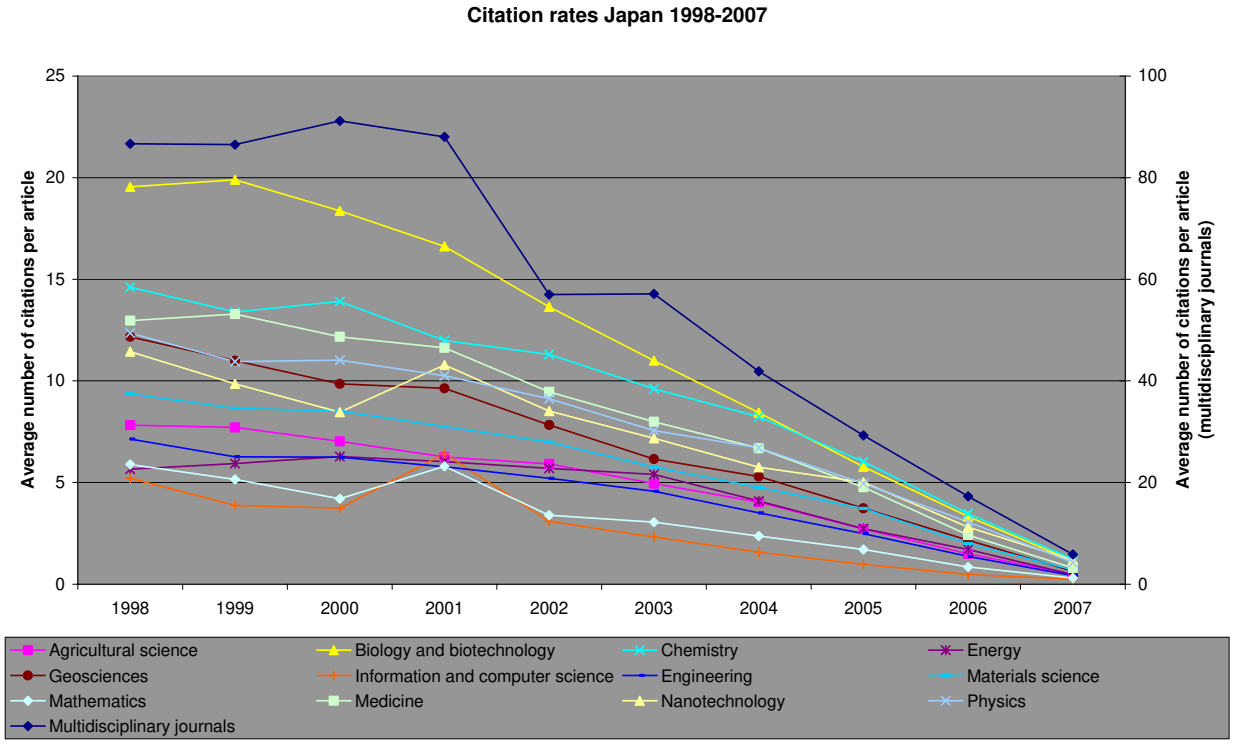

Figure 79: Citation rates for the disciplines studied (Japan)

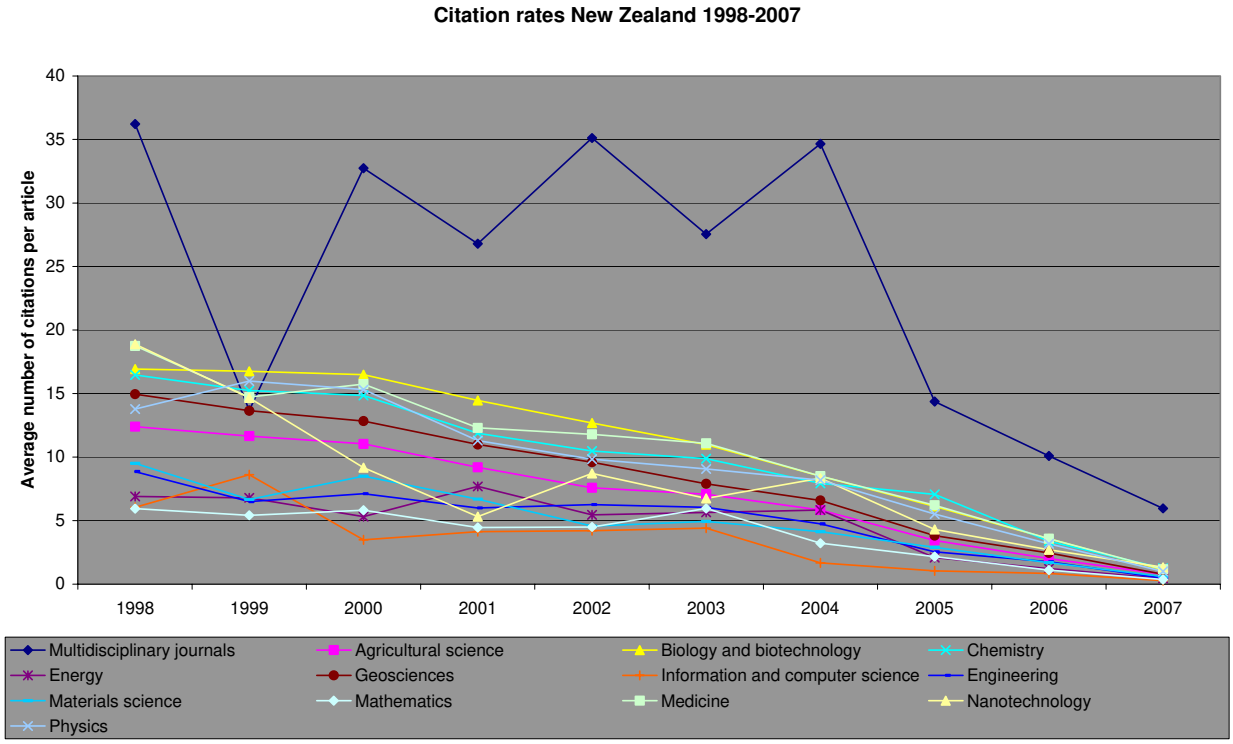

Figure 80: Citation rates for the disciplines studied (New Zealand)

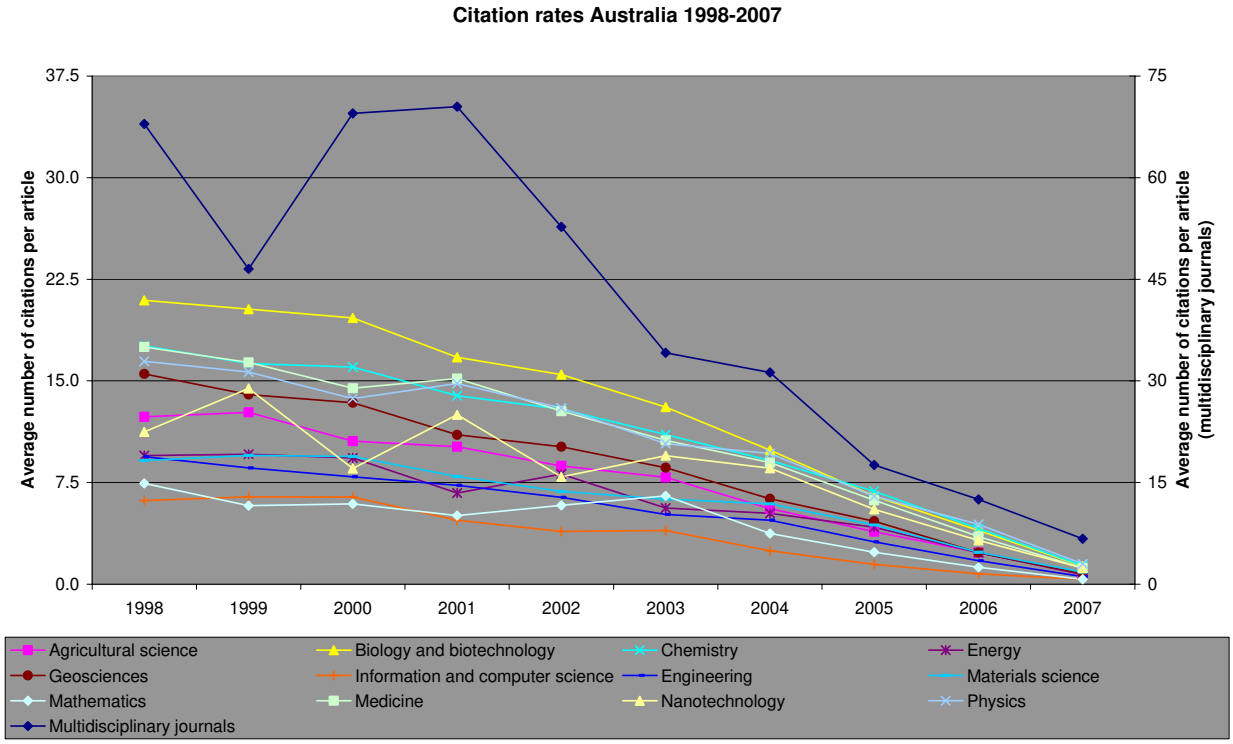

Figure 81: Citation rates for the disciplines studied (Australia)

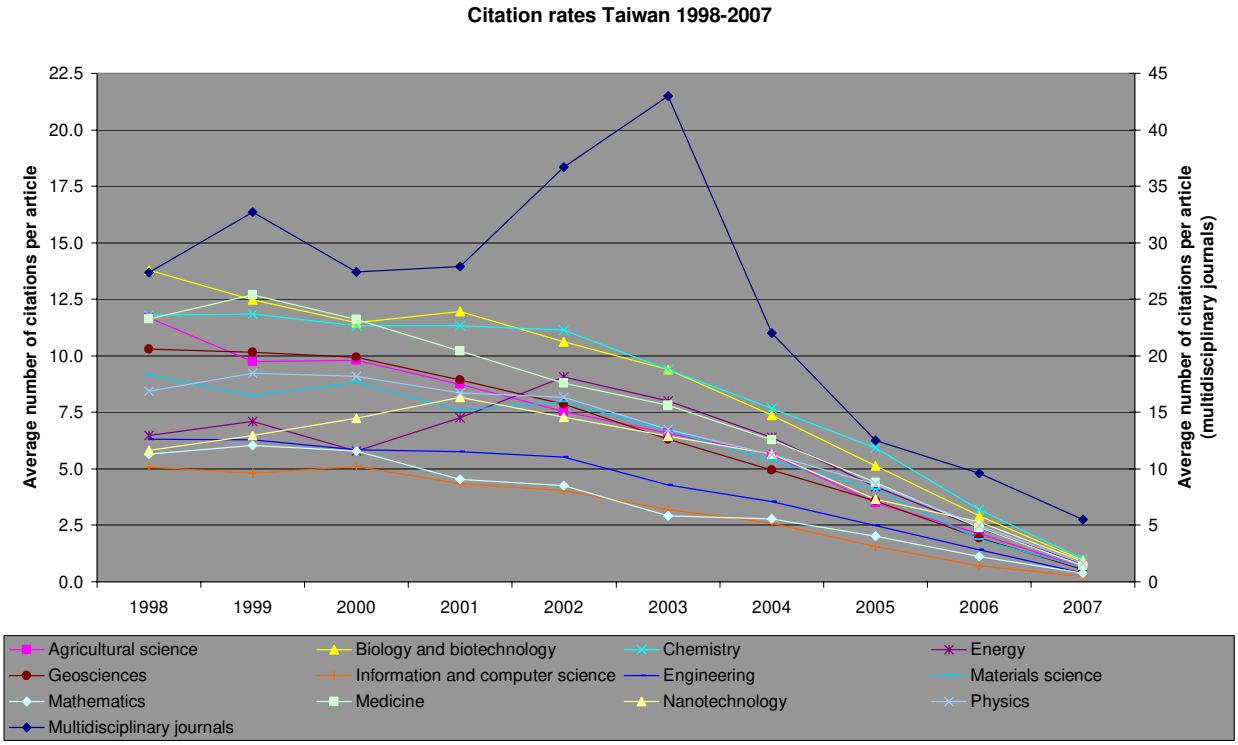

Figure 82: Citation rates for the disciplines studied (Taiwan)

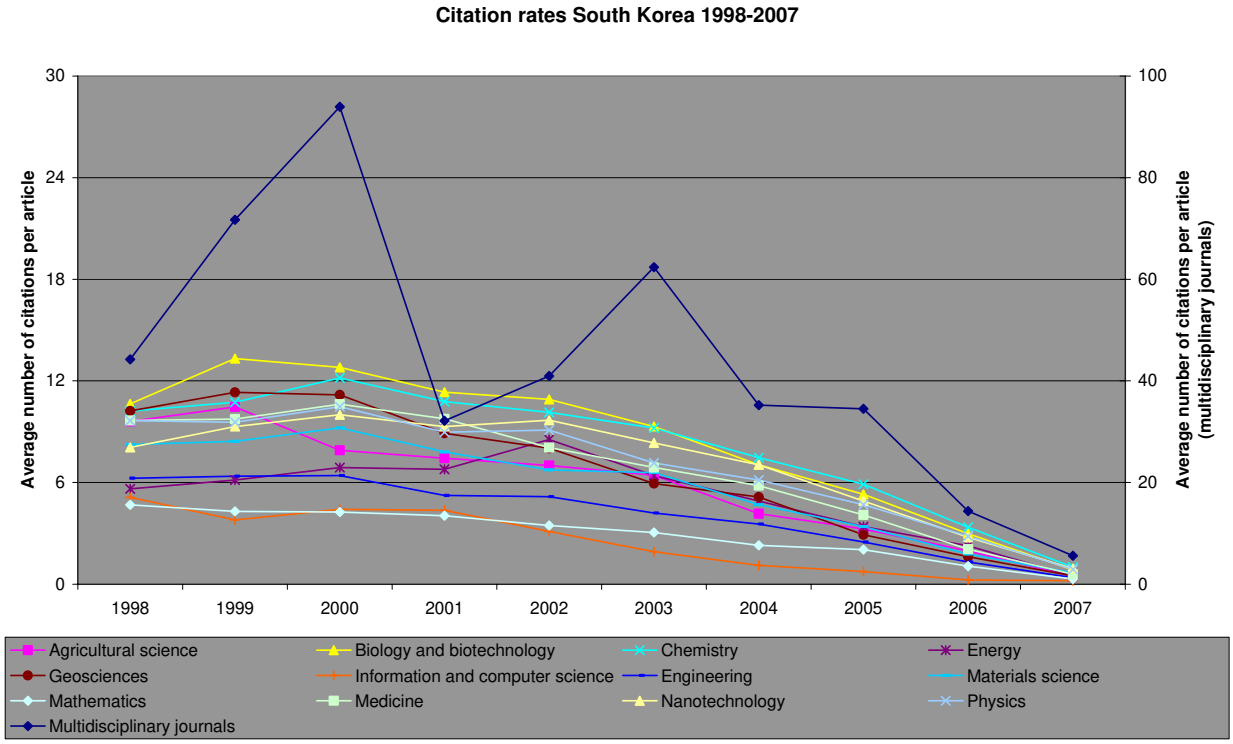

Figure 83: Citation rates for the disciplines studied (South Korea)

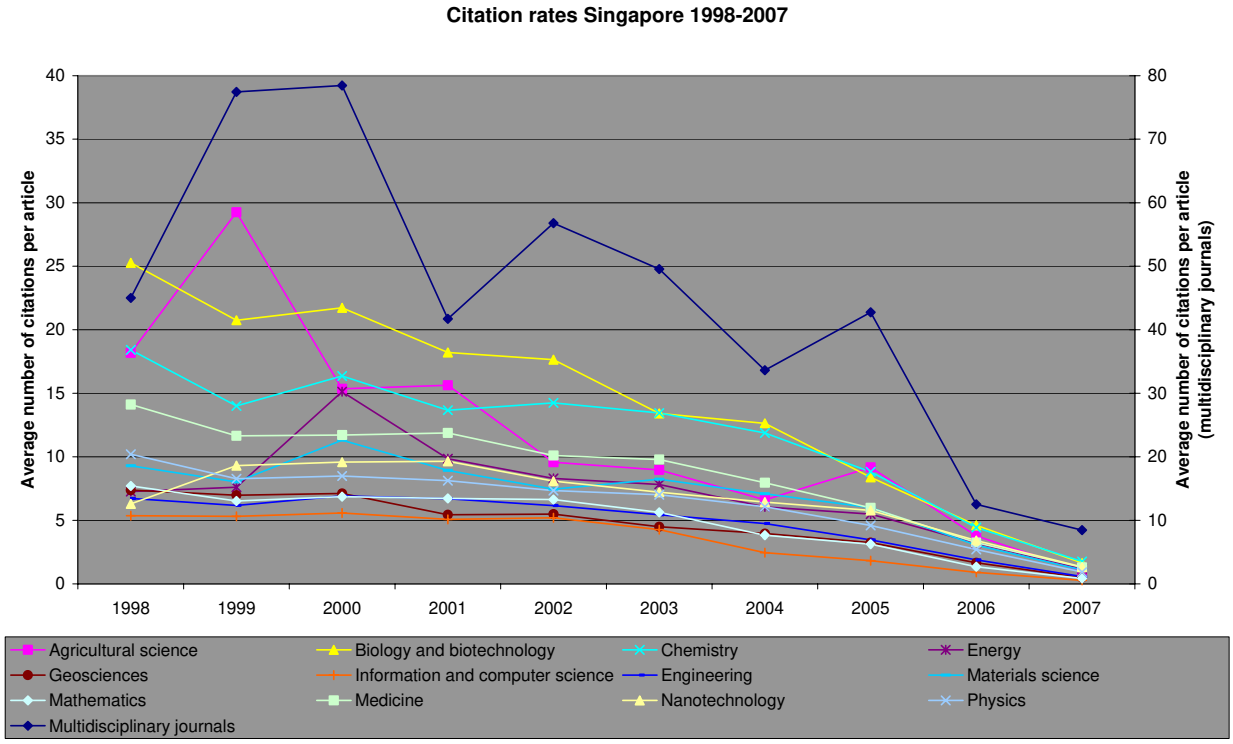

Figure 84: Citation rates for the disciplines studied (Singapore)

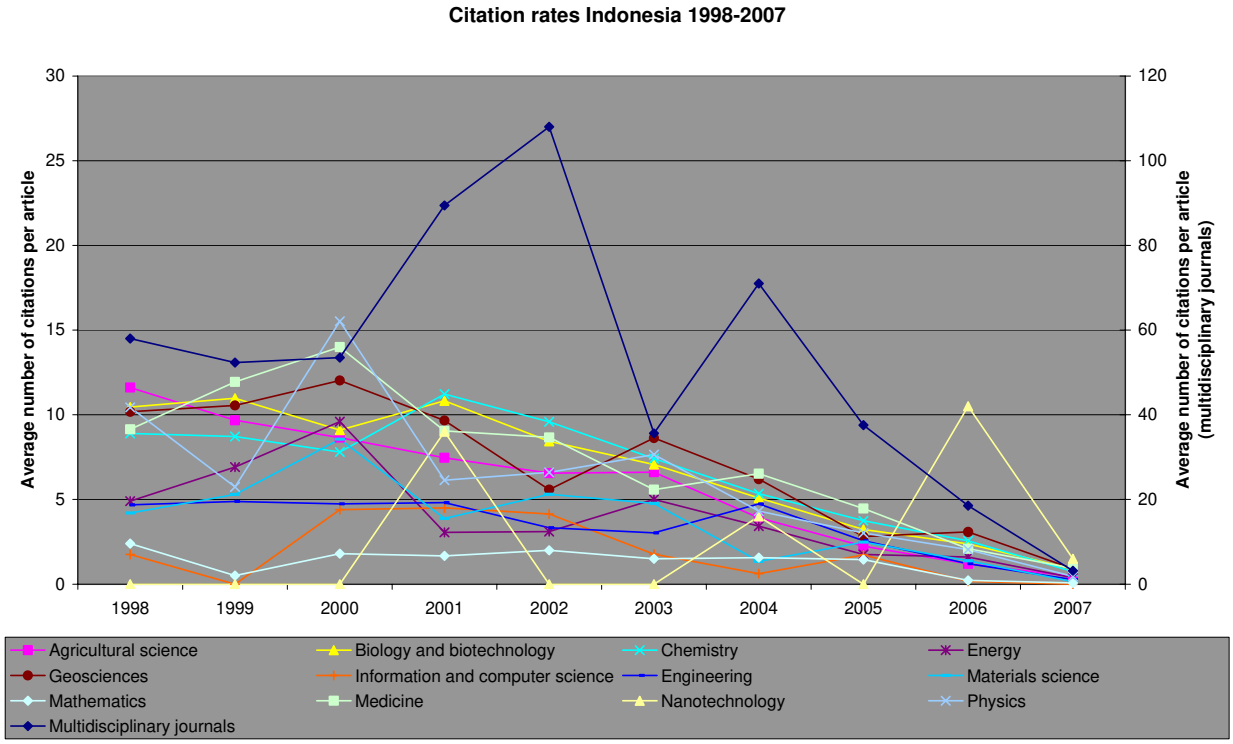

Figure 85: Citation rates for the disciplines studied (Indonesia)

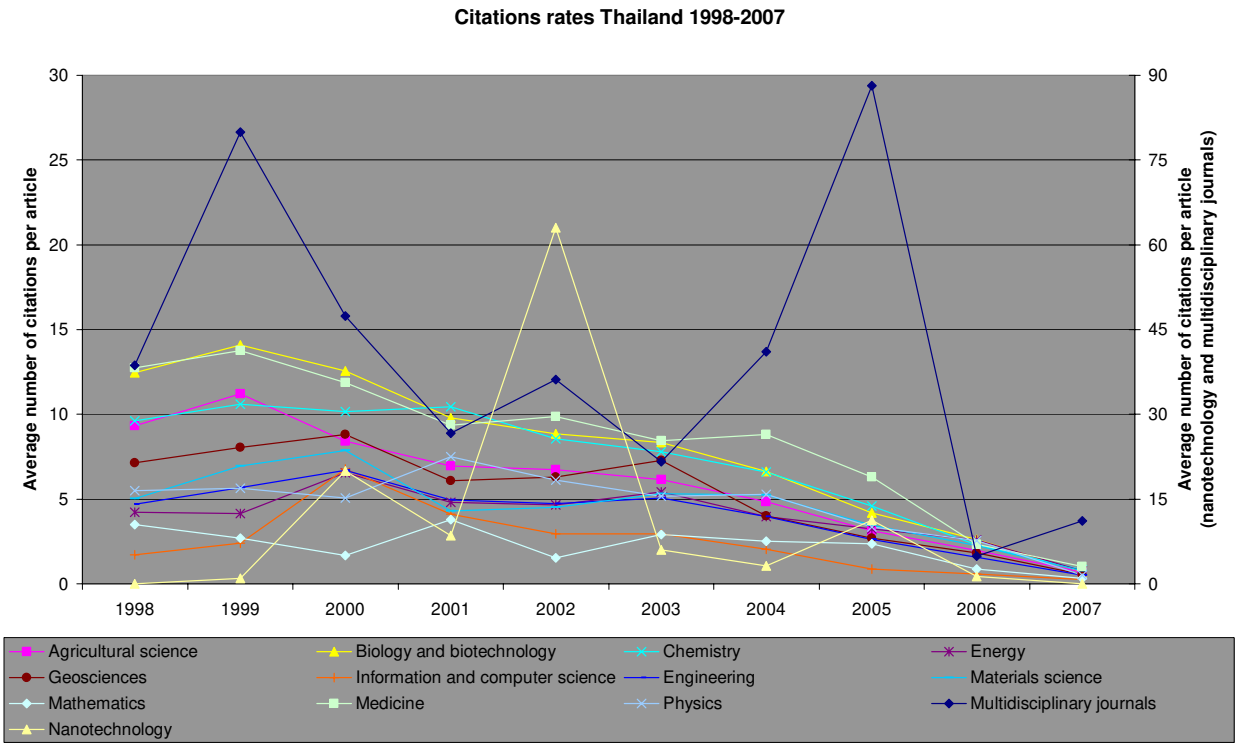

Figure 86: Citation rates for the disciplines studied (Thailand)

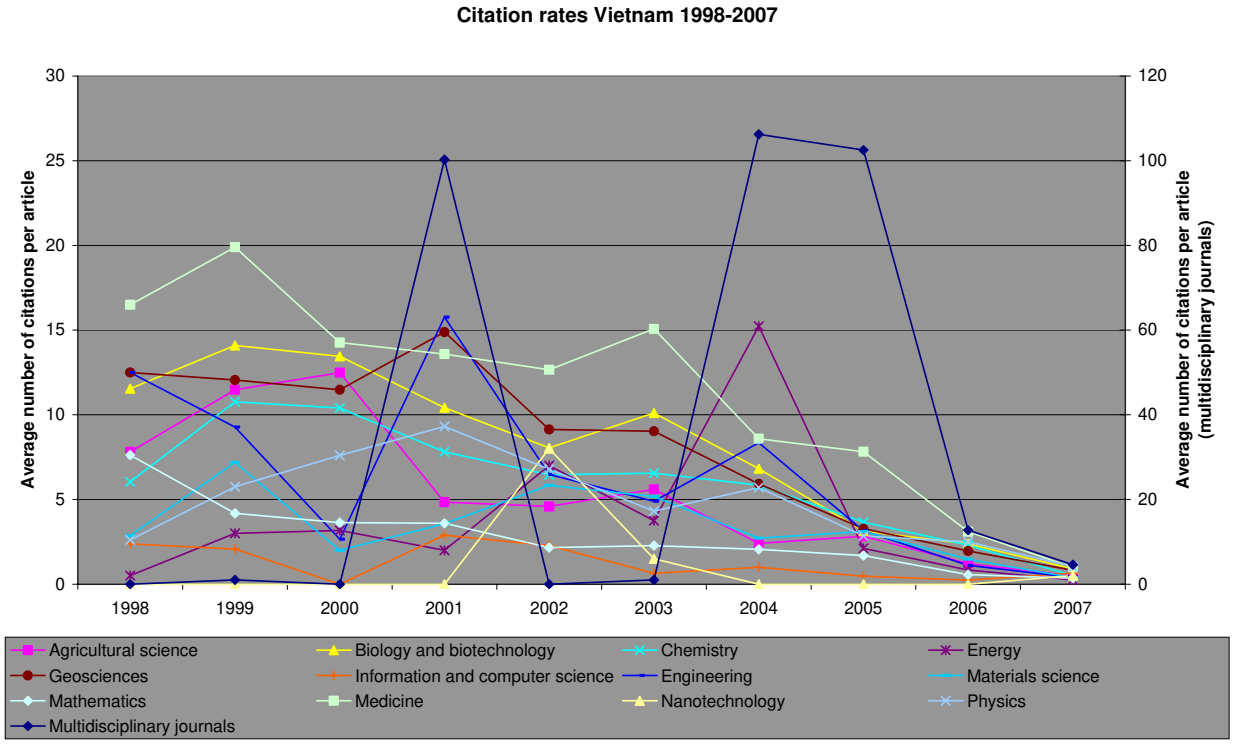

Figure 87: Citation rates for the disciplines studied (Vietnam)

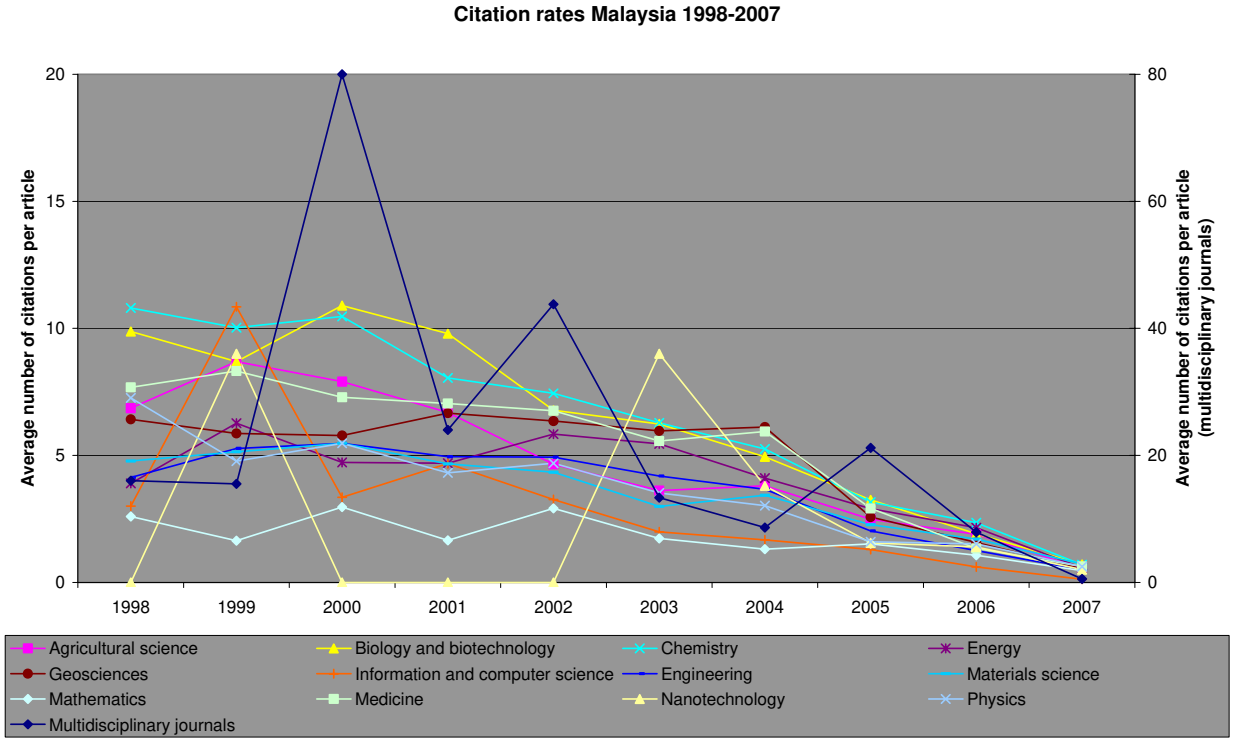

Figure 88: Citation rates for the disciplines studied (Malaysia)

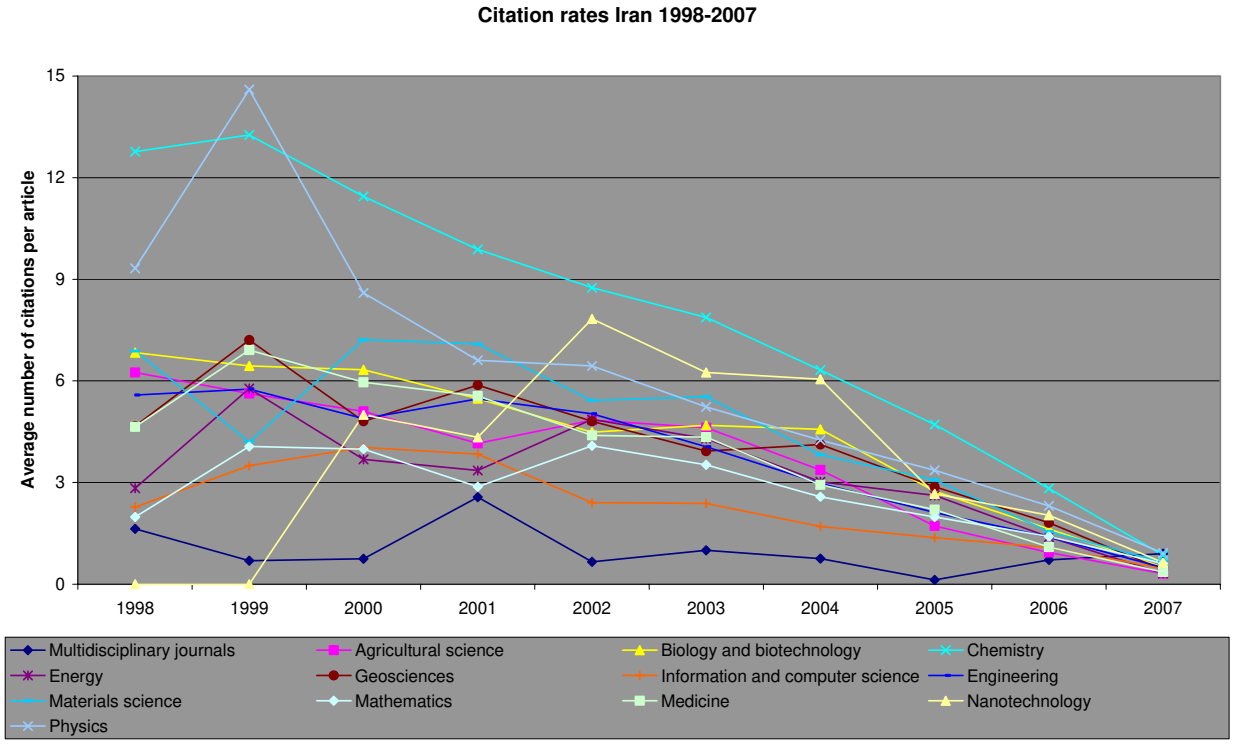

Figure 89: Citation rates for the disciplines studied (Iran)

3.3 Publication Output and Perception of Countries Compared to Germany

In order to compare the perception generated by a country with its publication performance, this section will take Germany as a benchmark and conduct a comparative study of each country and Germany (for the entire period under review 1998 to 2007).

Figures 90(a) to 101(a) compare the number of publications by a country in each discipline with the benchmark using the following formula. This gives us the percentage of publications that a country produces in comparison to Germany. A negative value indicates in percent how far below the benchmark a particular country is, while a positive value indicates how many more publications the corresponding country has produced compared to Germany in that particular subject.

$$\frac{P_C - P_G}{P_G} \cdot 100\%$$

where
P_C = number of publications by country C
P_G = number of publications by Germany

Thanks to the analyses in the previous chapters, we know that most of the countries boast a rather small publication output. The way we illustrate our results here allows us to compare the countries in a discipline and determine those countries that publish either more or less than Germany, the disciplines in which they do so, and the degree to which they do so. Taken as a whole, we found only two countries that produce more scientific articles in individual disciplines than Germany: Japan (in 8 disciplines) and China (in 6 disciplines). In the case of all of the other countries, we can see the degree to which each country lies below the comparative value for Germany.

The perception of the countries is measured against the scientific perception of Germany in Figures 90(b) to 101(b). In order to measure the perception, we determine what percentage of Germany's citation rate a country achieves in a particular discipline. As was the case in the previous analysis, a negative value indicates how far below the benchmark a country lies, while a positive value correspondingly indicates how much higher (in percent) the citation rate of the respective country is in relation to that of Germany in that particular subject. The calculations are based on the following formula, which is equivalent to the previous comparison of the number of publications:

$$\frac{CPP_C - CPP_G}{CPP_G} \cdot 100\%$$

where
CPP_C = citation rate of country C
CPP_G = citation rate of Germany

It can be seen that China lies well below expectations in all of the disciplines analysed despite its high publication output. China lies below the citation level of Germany in all of the disciplines investigated. This is not the case for some of the other countries studied: in 4 of the 13 disciplines analysed, Australia generated a higher or at least the same perception as Germany, despite the fact that Australia's publication output is well below the level of China or Germany. From this, we can conclude that a high number of publications alone is not a guarantee for a high perception. The inverse holds for a comparably low publication output in that this does not automatically mean that a country has no chance of a relatively high international visibility.

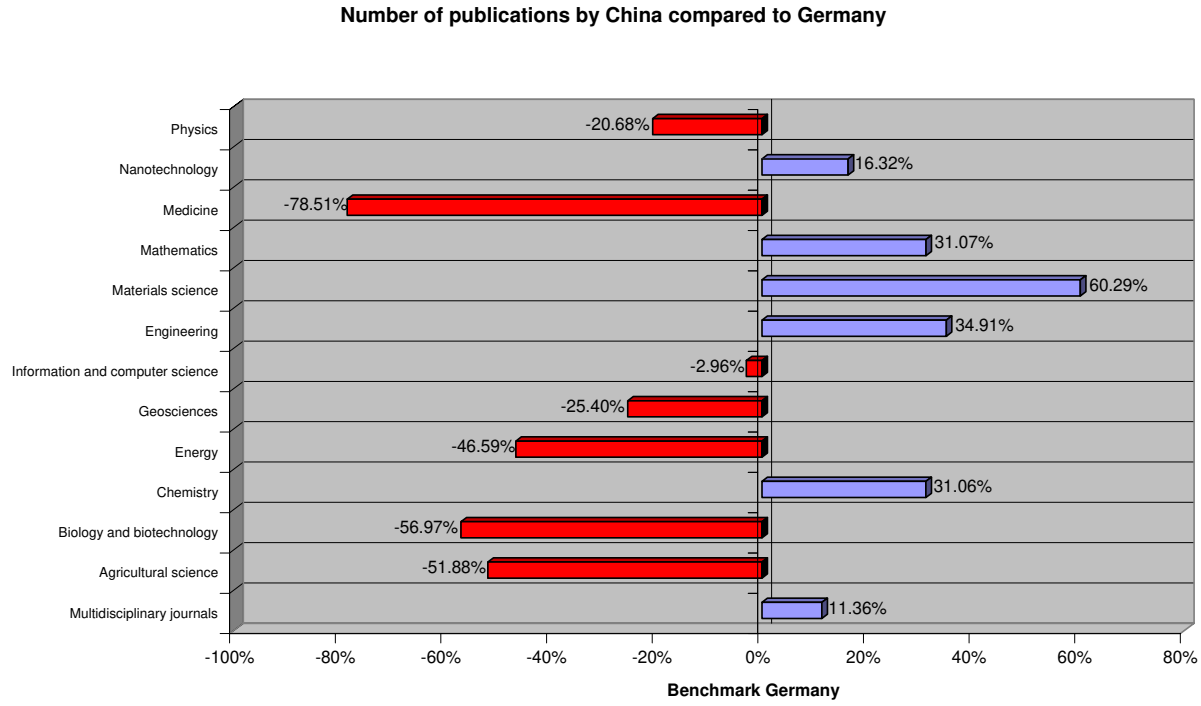

Figure 90(a): Number of publications by China compared to the selected benchmark Germany

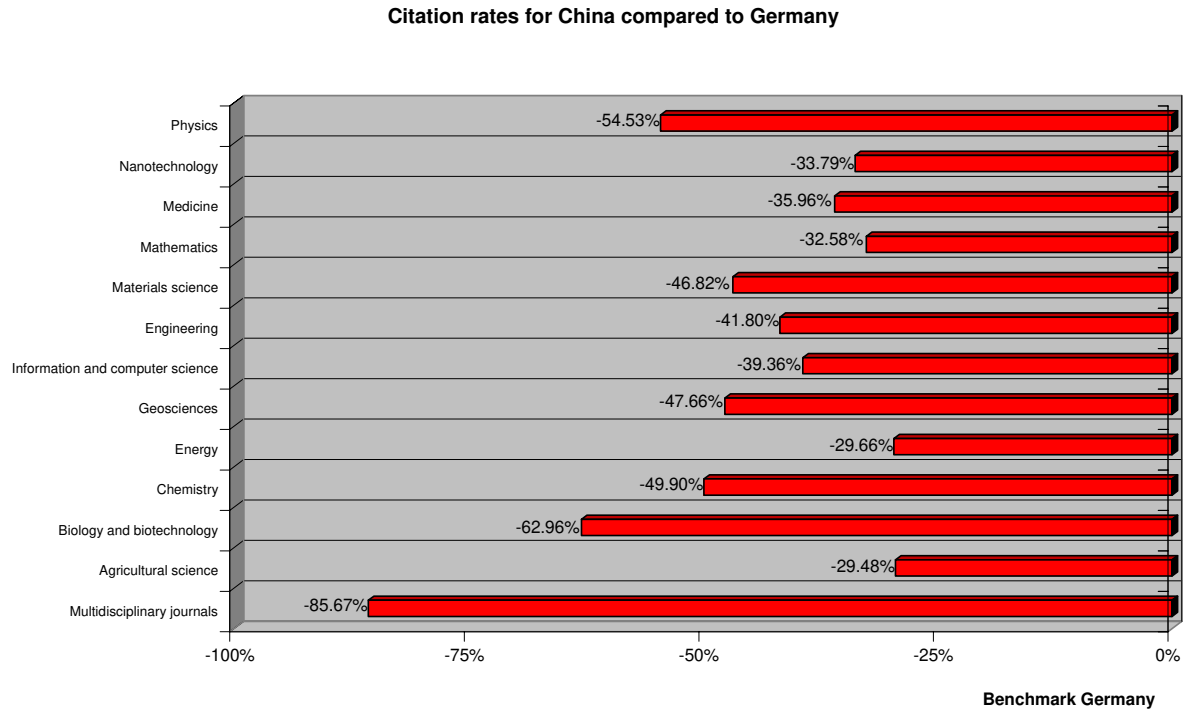

Figure 90(b): Citation rates for China compared to the selected benchmark Germany

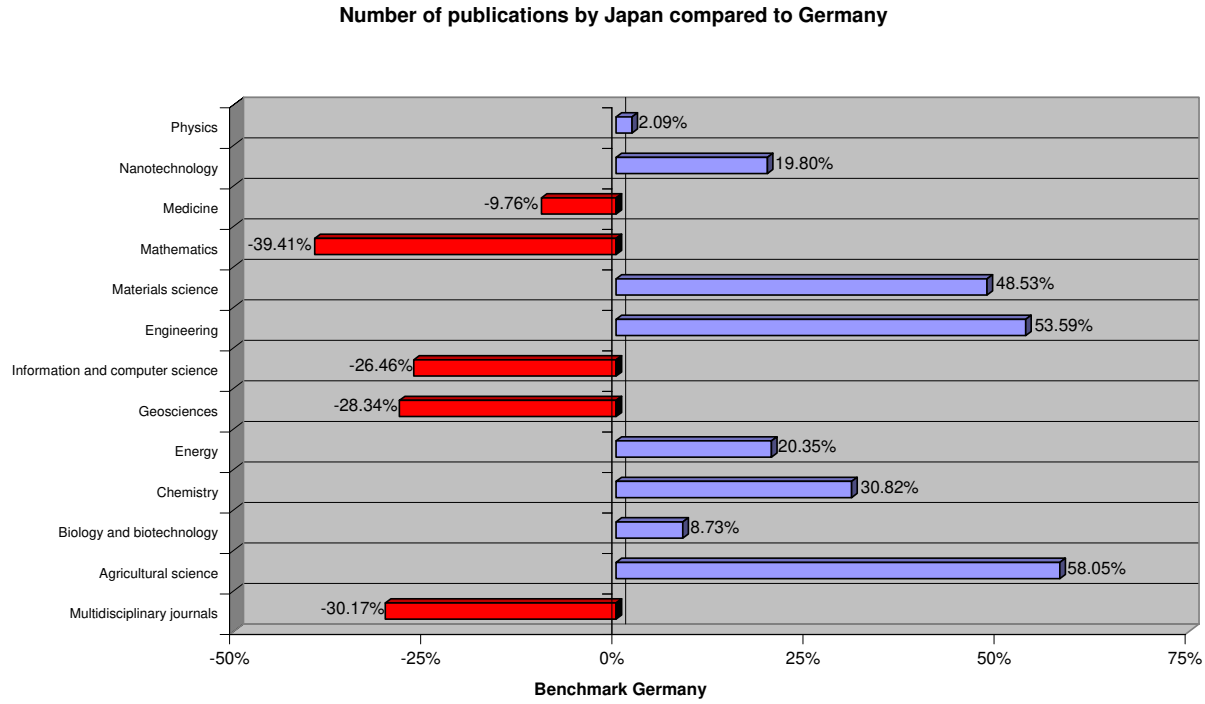

Figure 91(a): Number of publications by Japan compared to the selected benchmark Germany

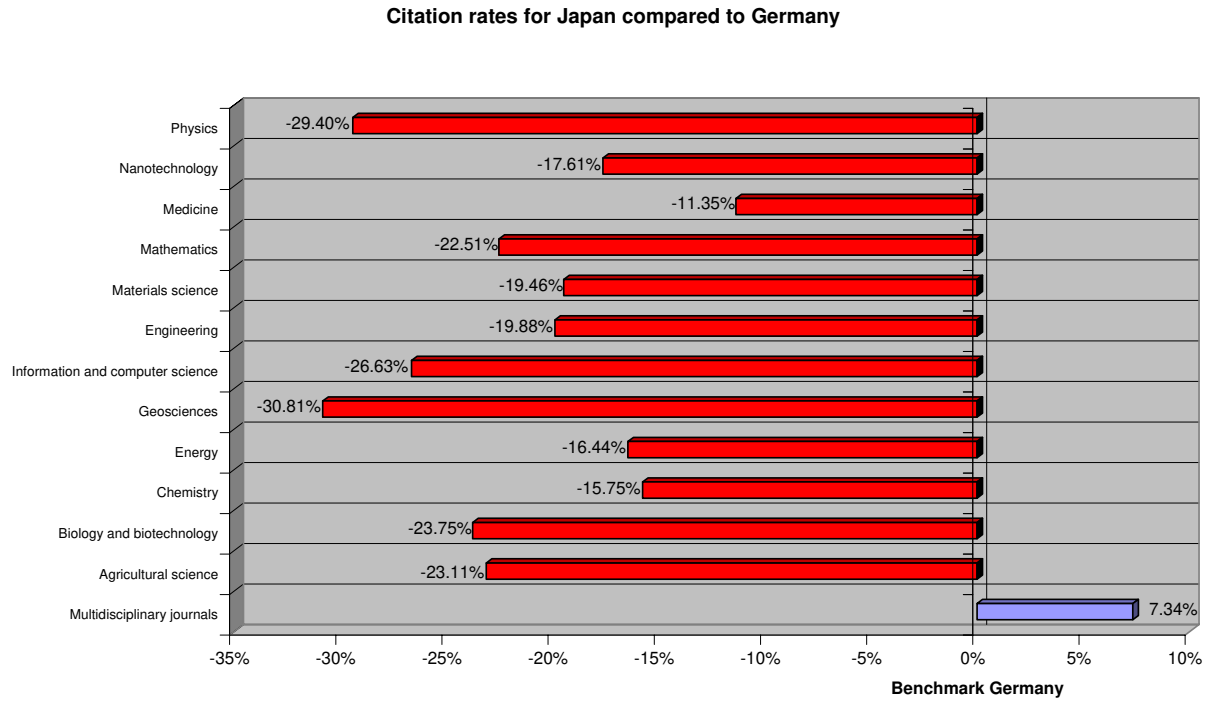

Figure 91(b): Citation rates for Japan compared to the selected benchmark Germany

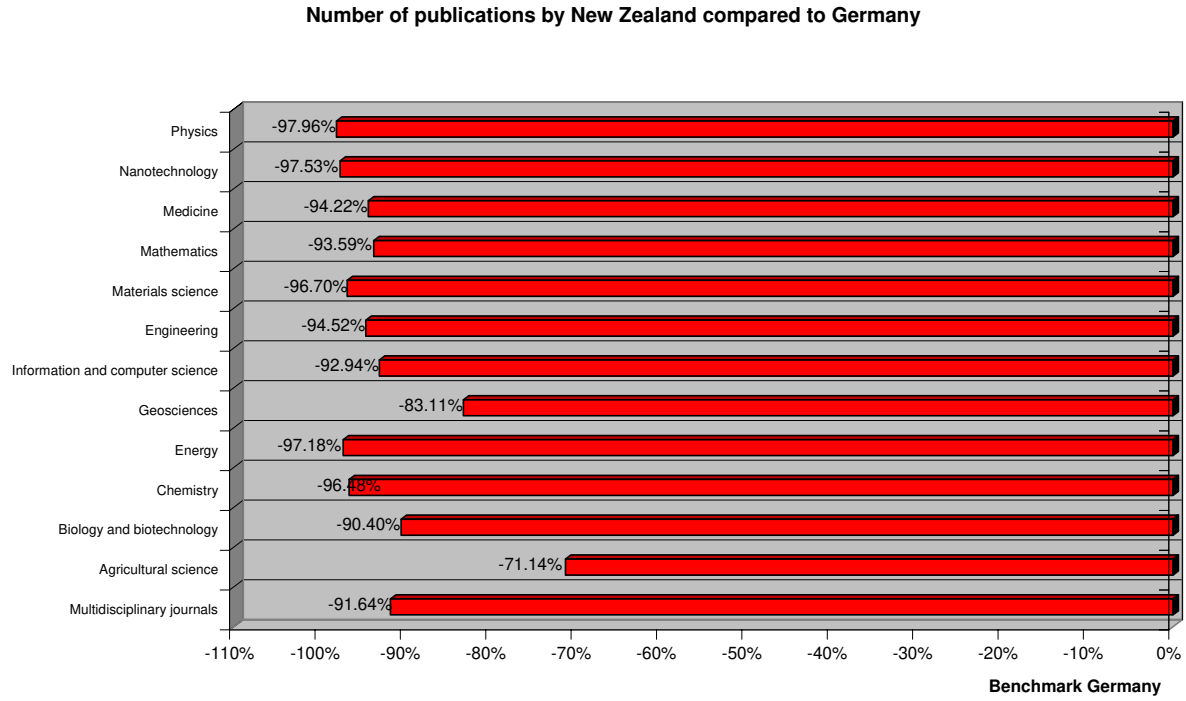

Figure 92(a): Number of publications by New Zealand compared to the selected benchmark Germany

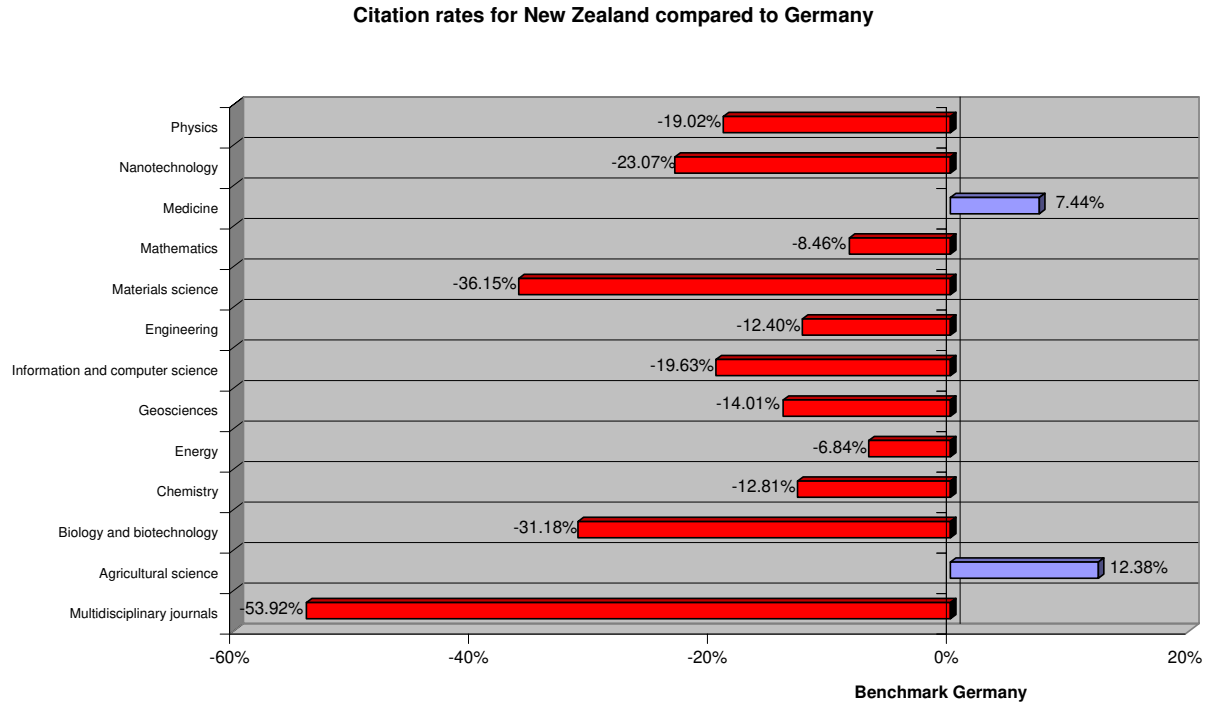

Figure 92(b): Citation rates for New Zealand compared to the selected benchmark Germany

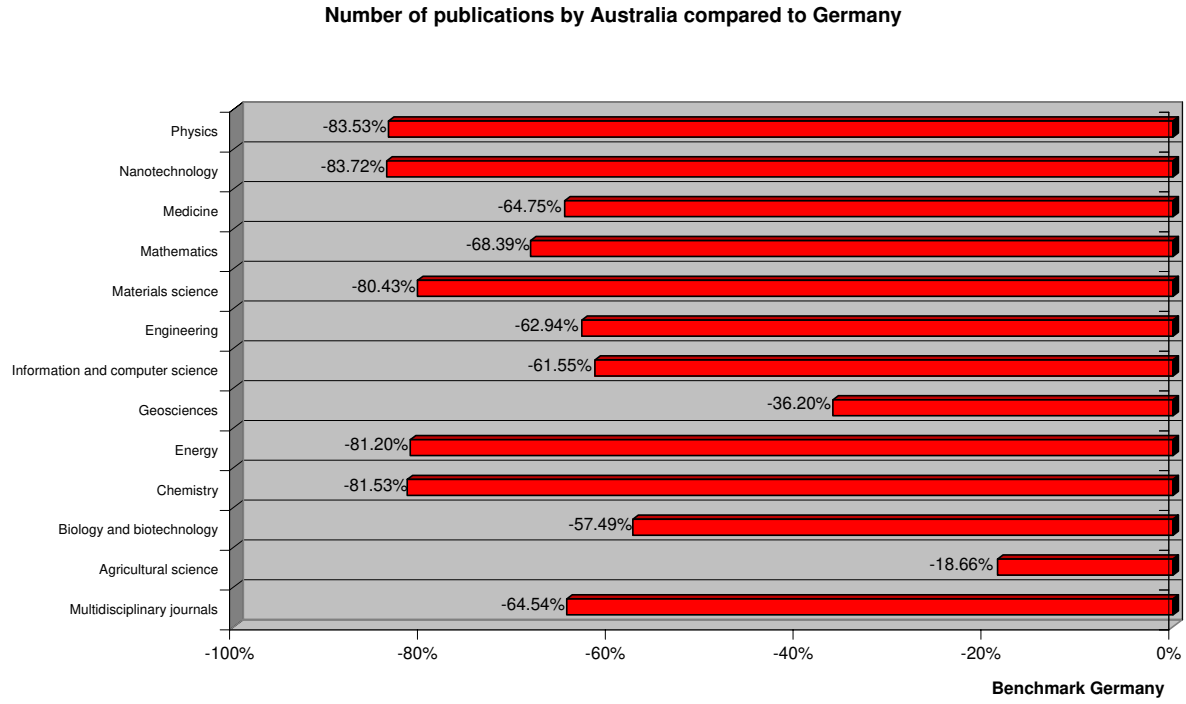

Figure 93(a): Number of publications by Australia compared to the selected benchmark Germany

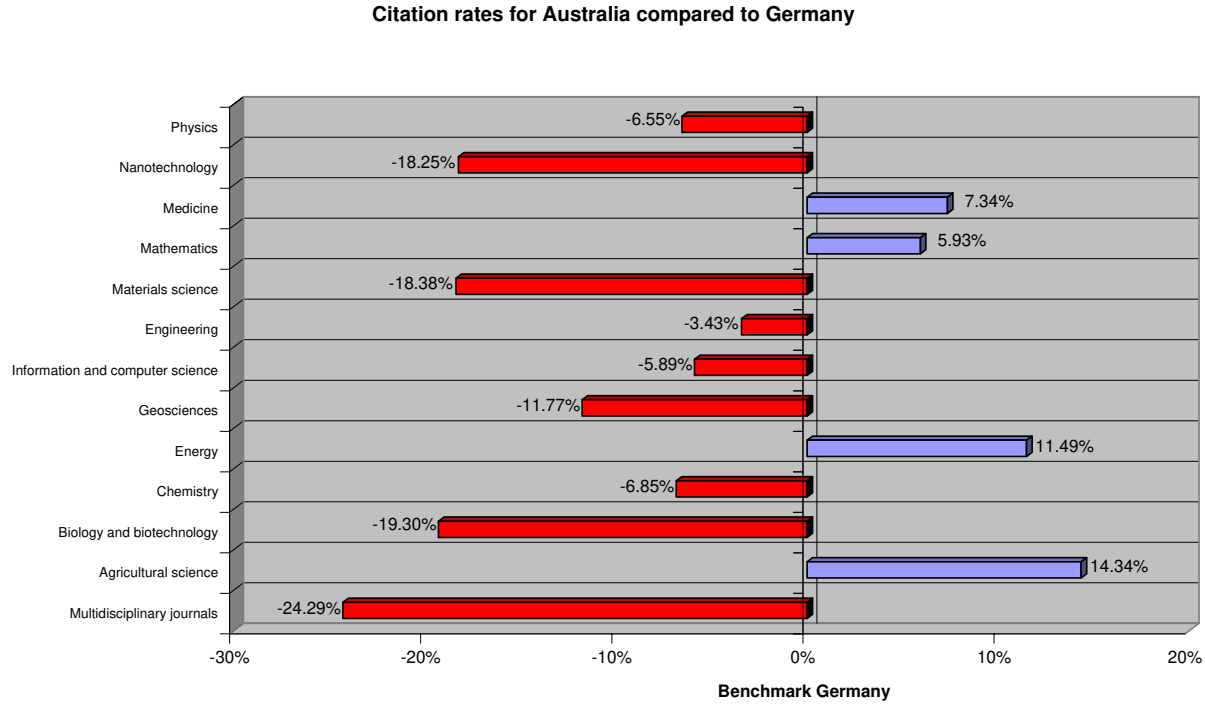

Figure 93(b): Citation rates for Australia compared to the selected benchmark Germany

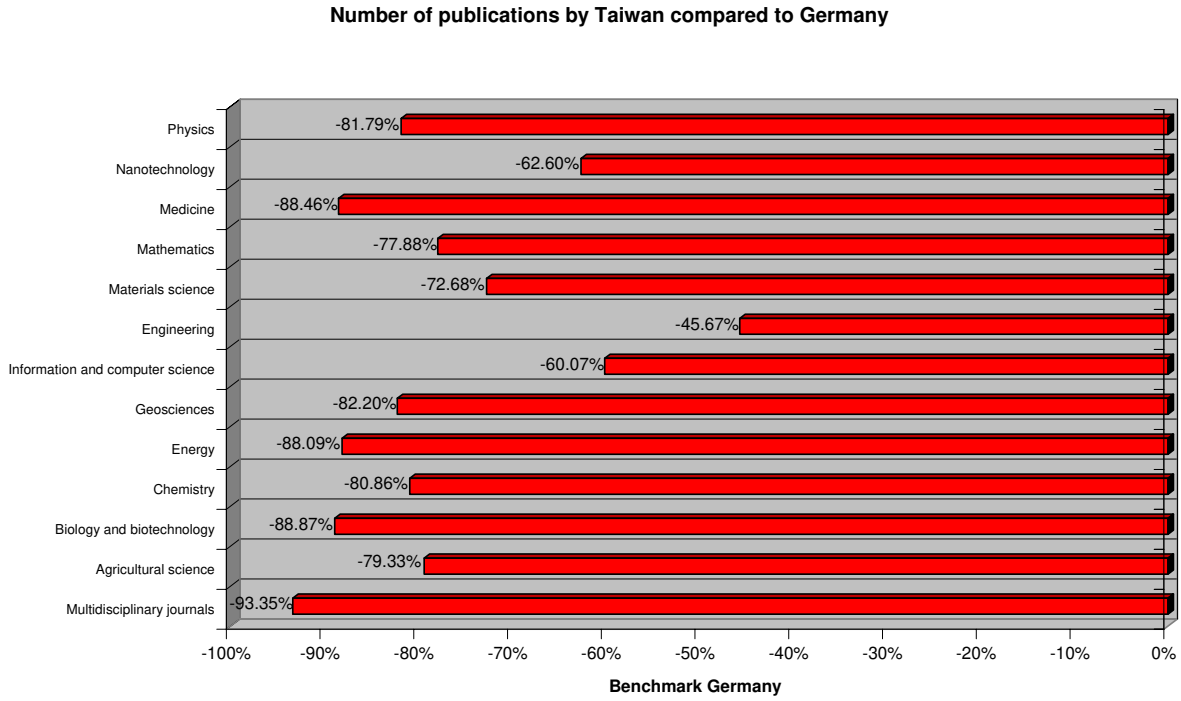

Figure 94(a): Number of publications by Taiwan compared to the selected benchmark Germany

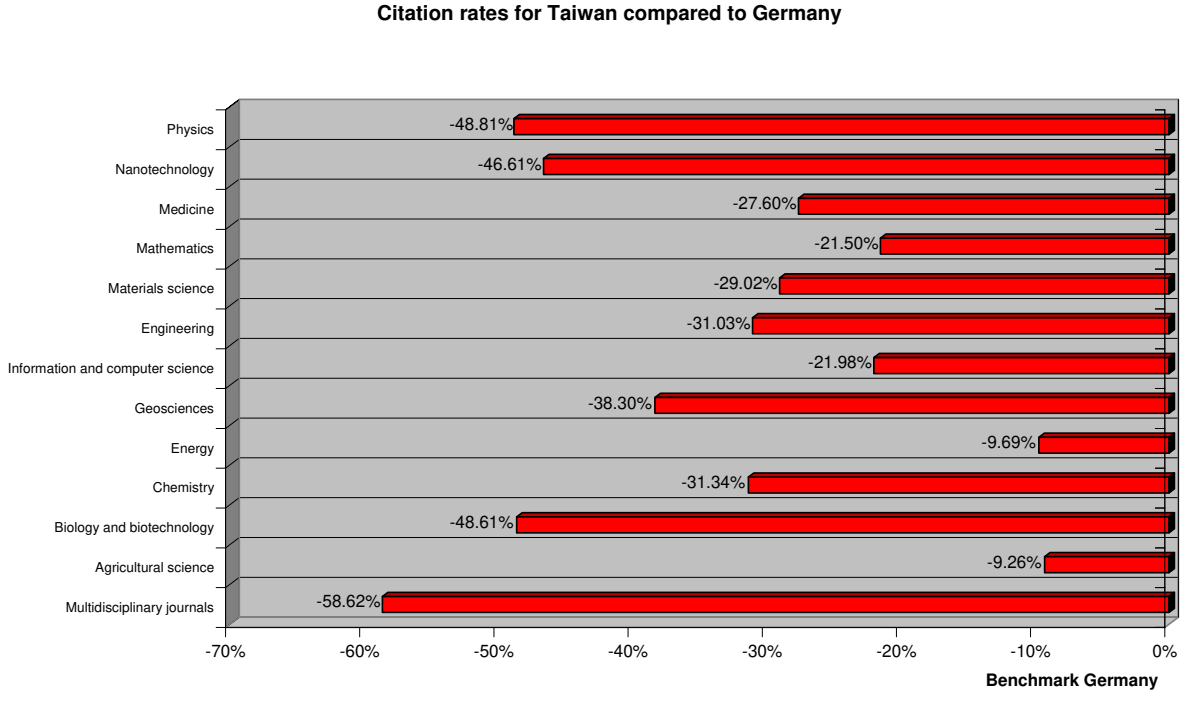

Figure 94(b): Citation rates for Taiwan compared to the selected benchmark Germany

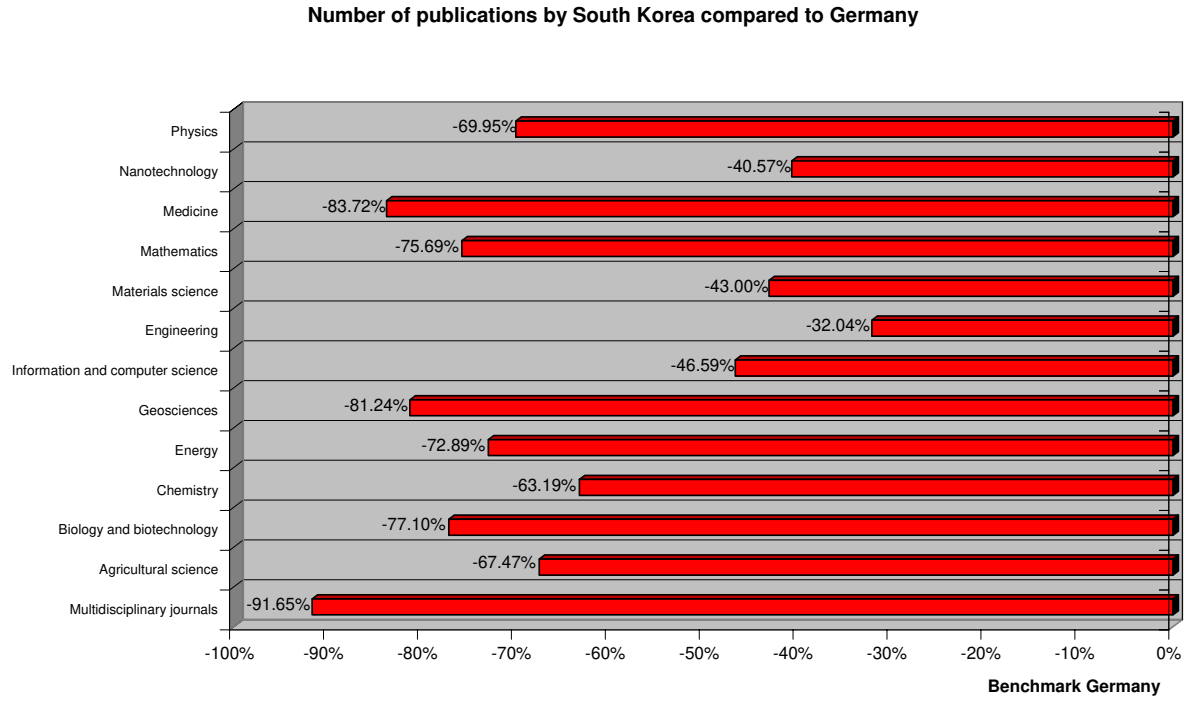

Figure 95(a): Number of publications by South Korea compared to the selected benchmark Germany

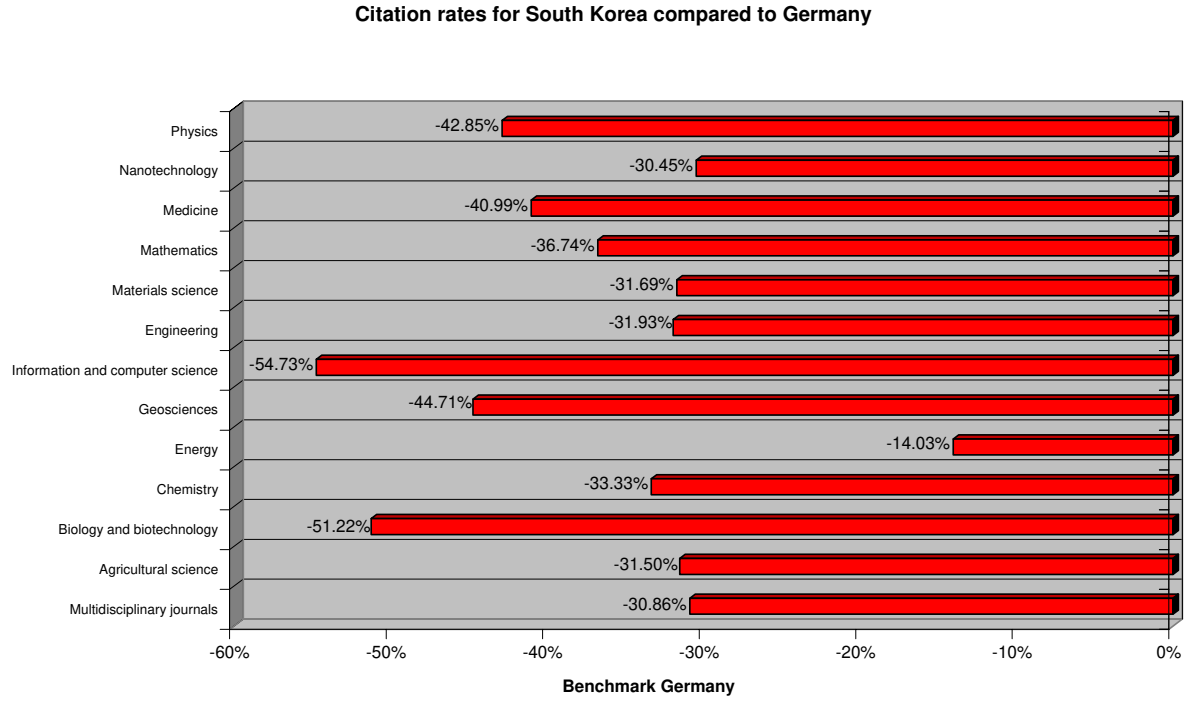

Figure 95(b): Citation rates for South Korea compared to the selected benchmark Germany

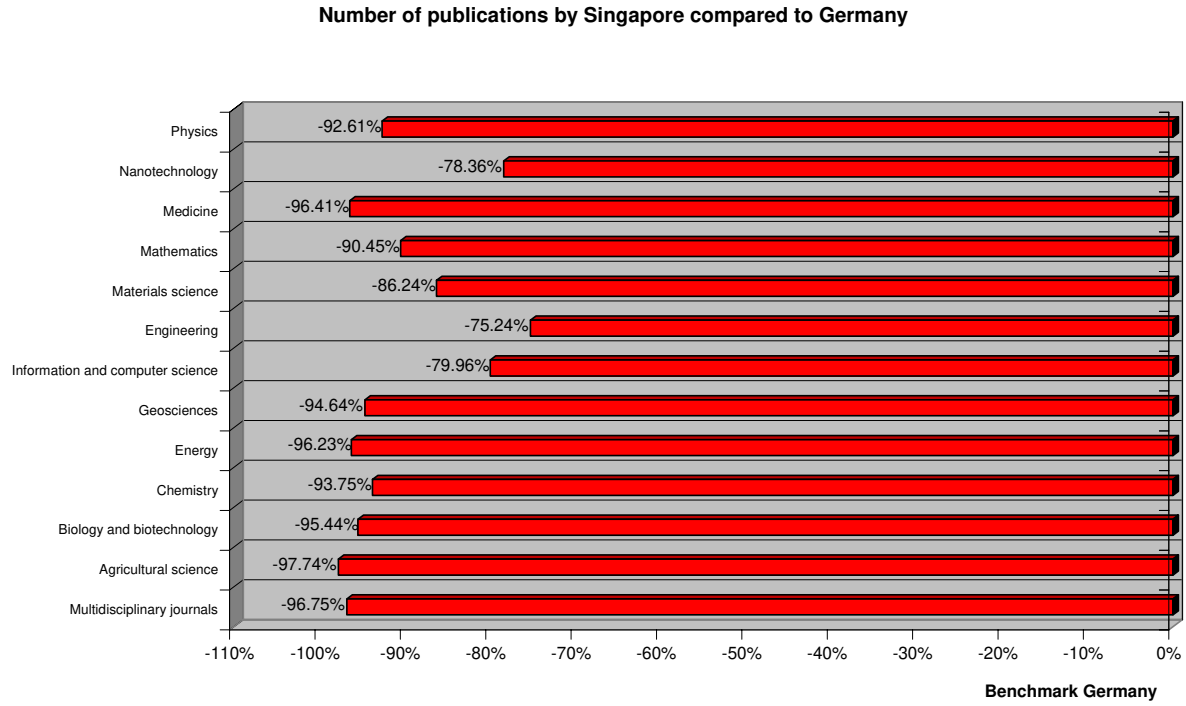

Figure 96(a): Number of publications by Singapore compared to the selected benchmark Germany

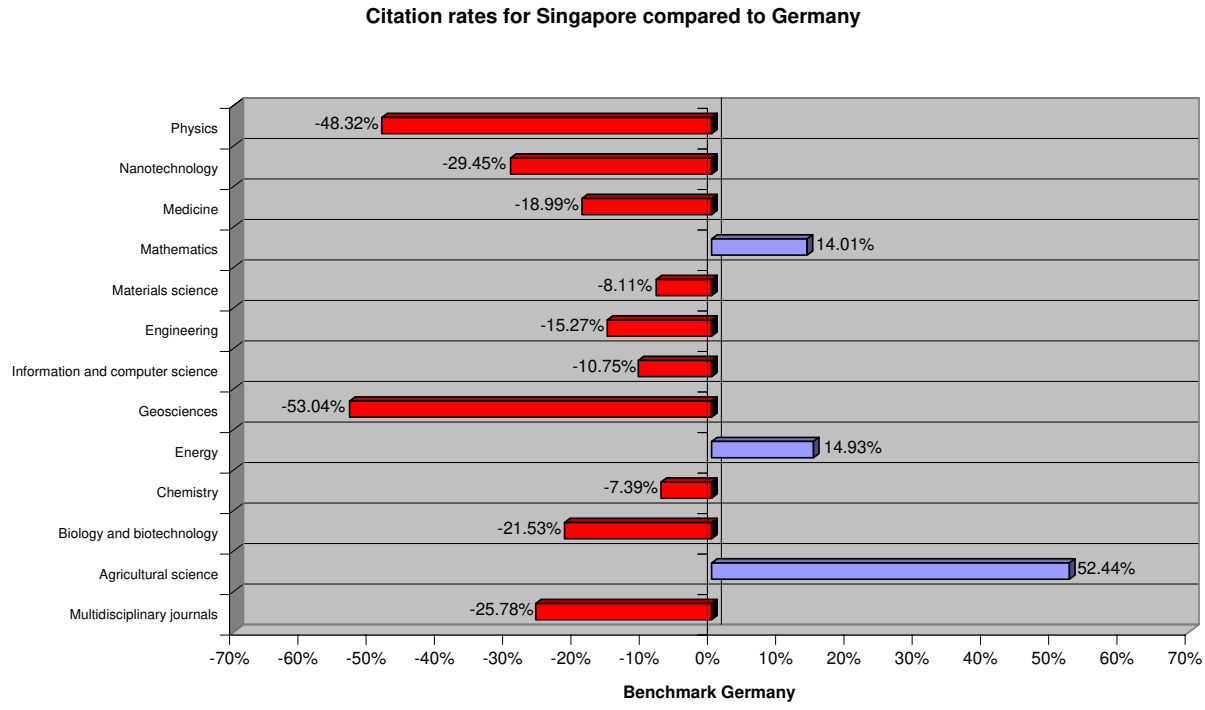

Figure 96(b): Citation rates for Singapore compared to the selected benchmark Germany

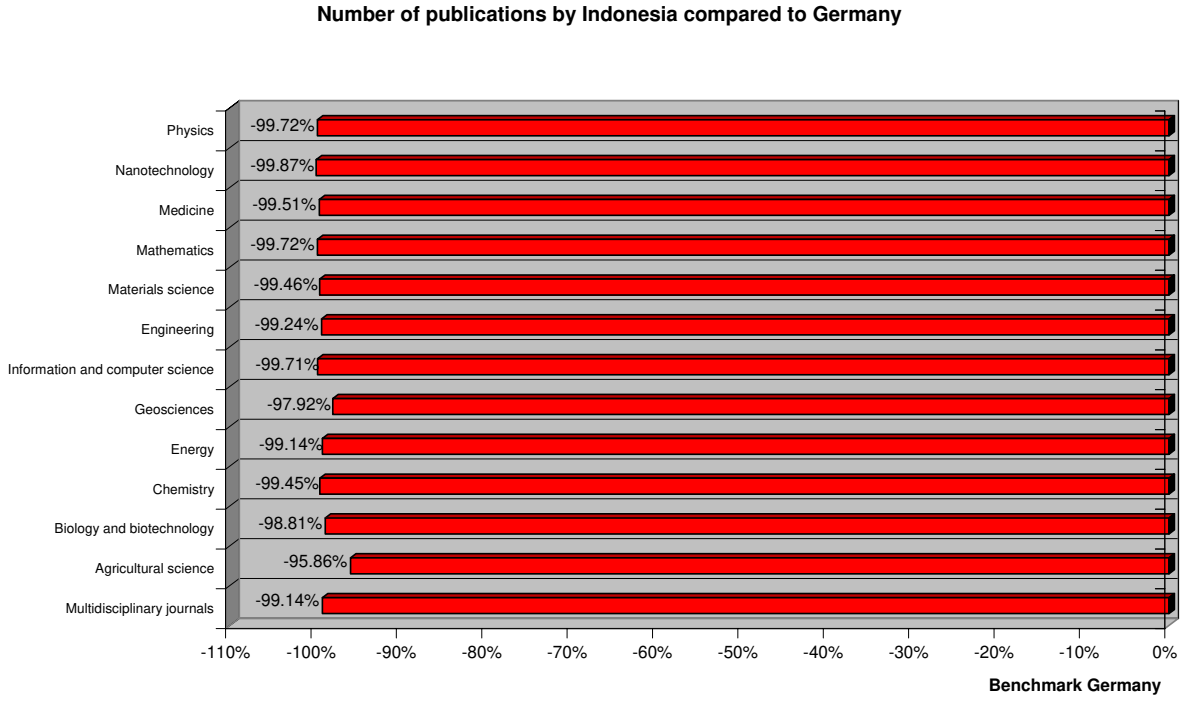

Figure 97(a): Number of publications by Indonesia compared to the selected benchmark Germany

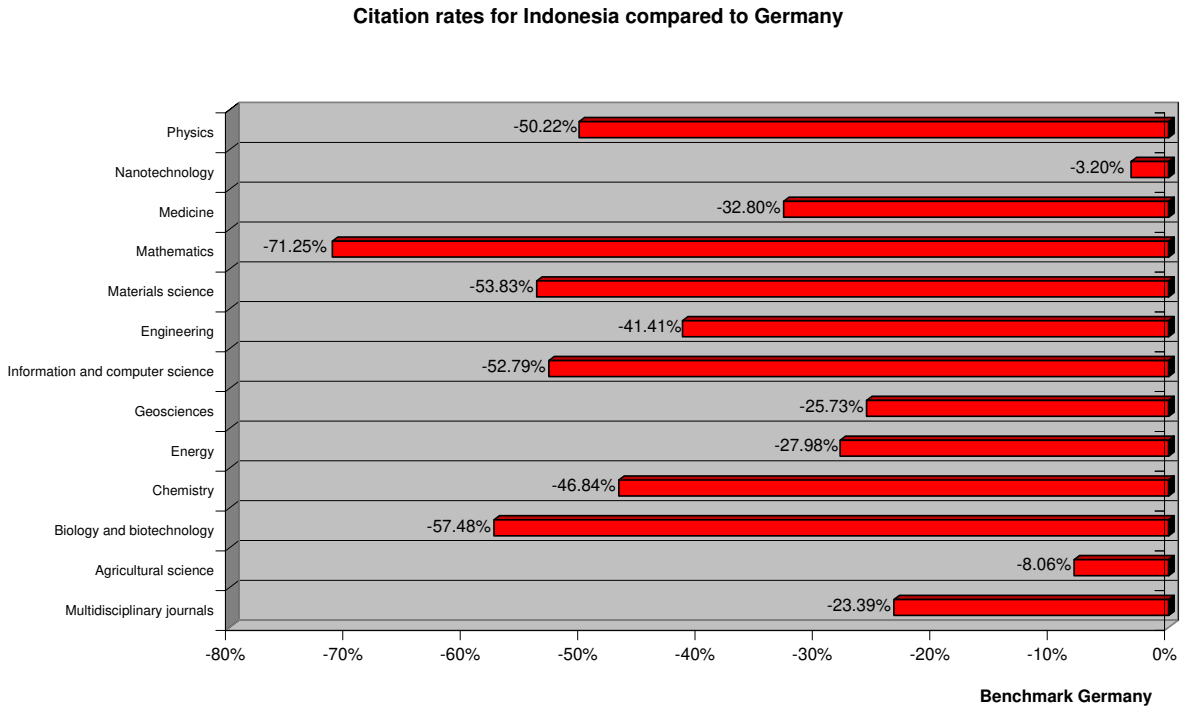

Figure 97(b): Citation rates for Indonesia compared to the selected benchmark Germany

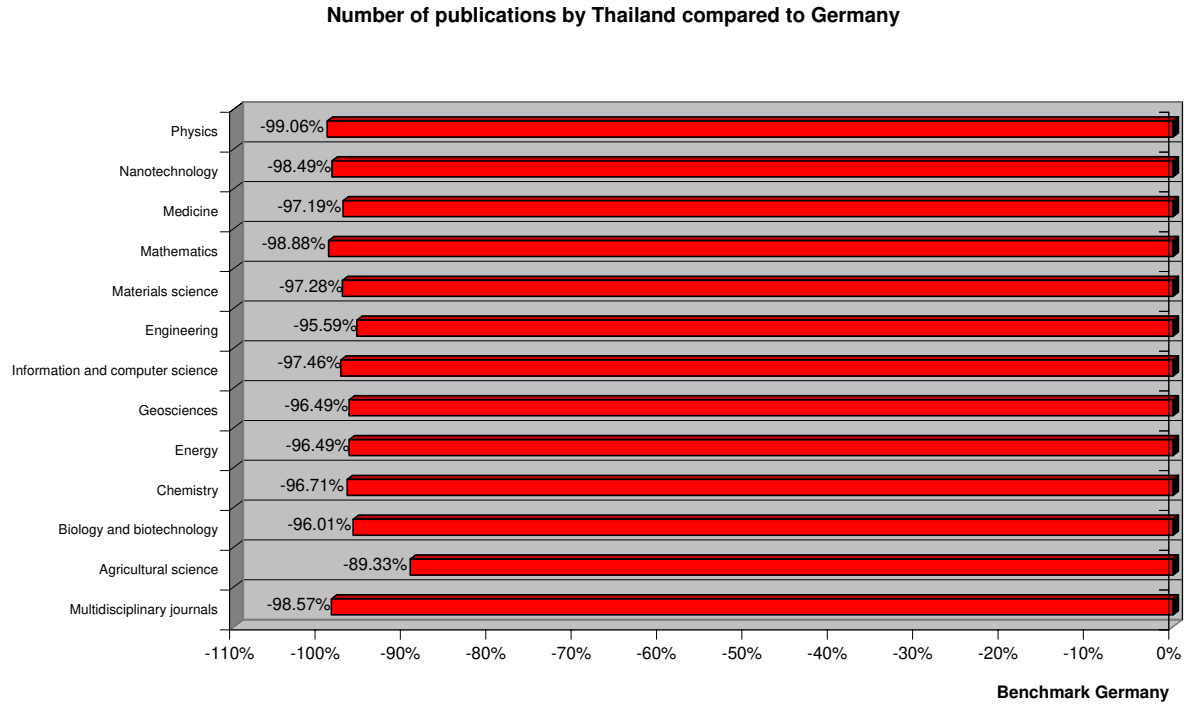

Figure 98(a): Number of publications by Thailand compared to the selected benchmark Germany

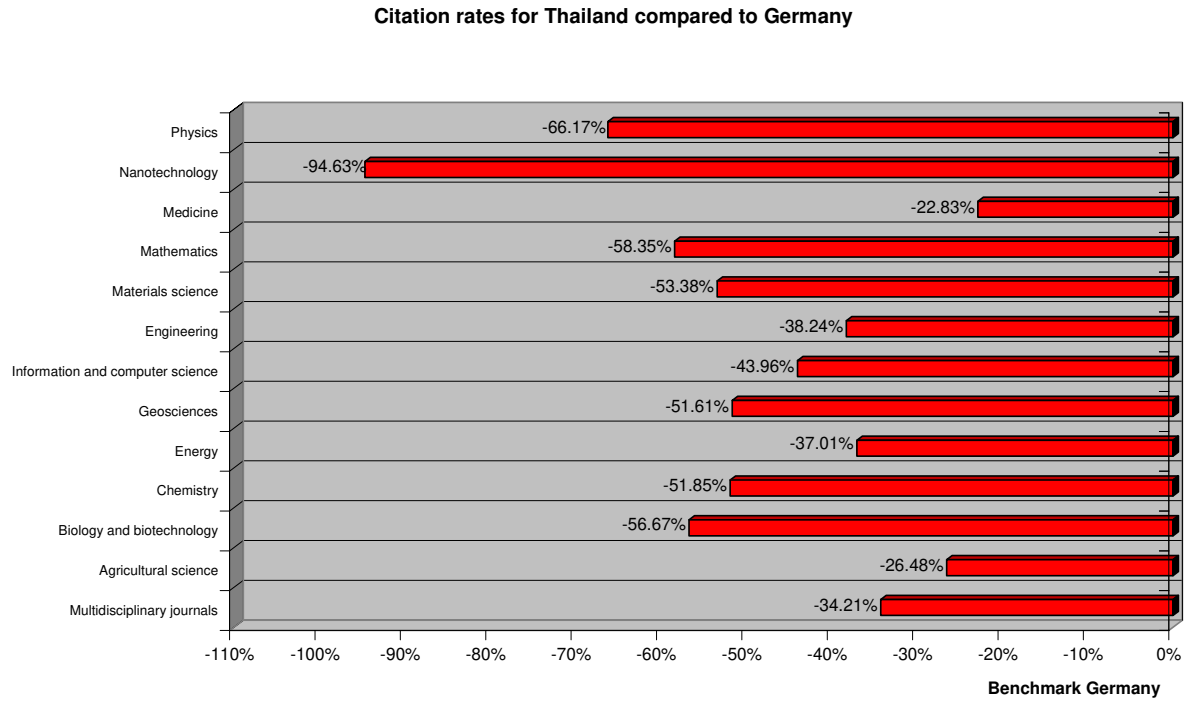

Figure 98(b): Citation rates for Thailand compared to the selected benchmark Germany

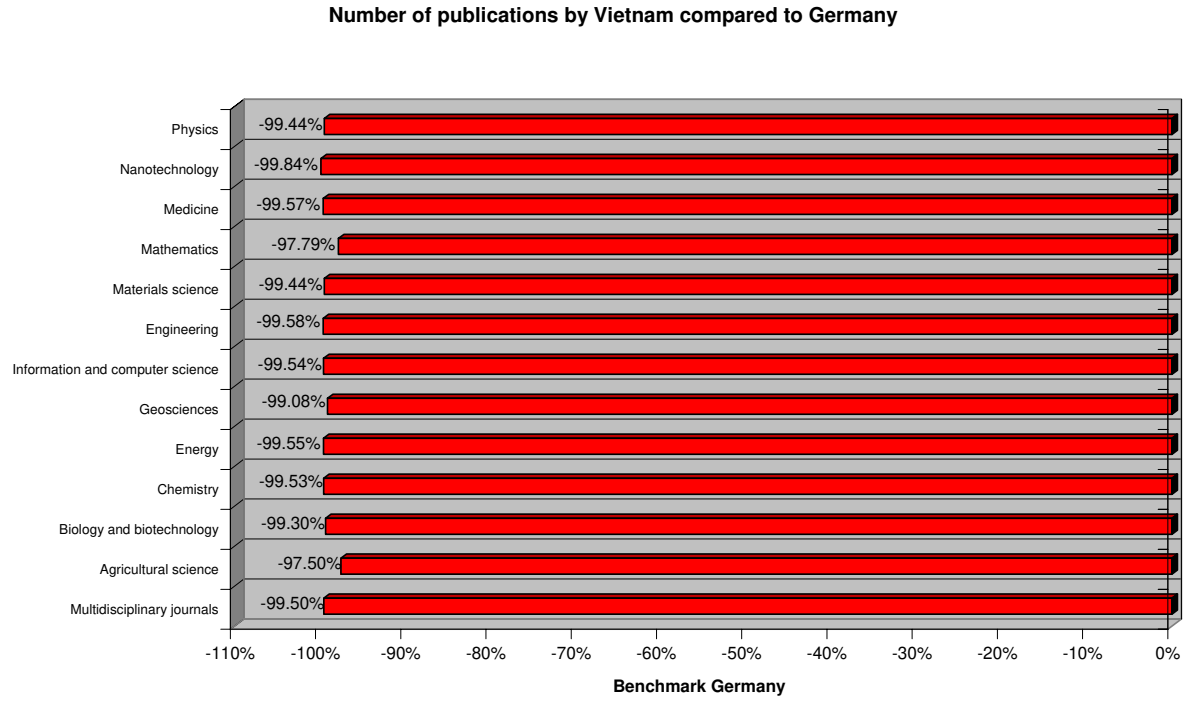

Figure 99(a): Number of publications by Vietnam compared to the selected benchmark Germany

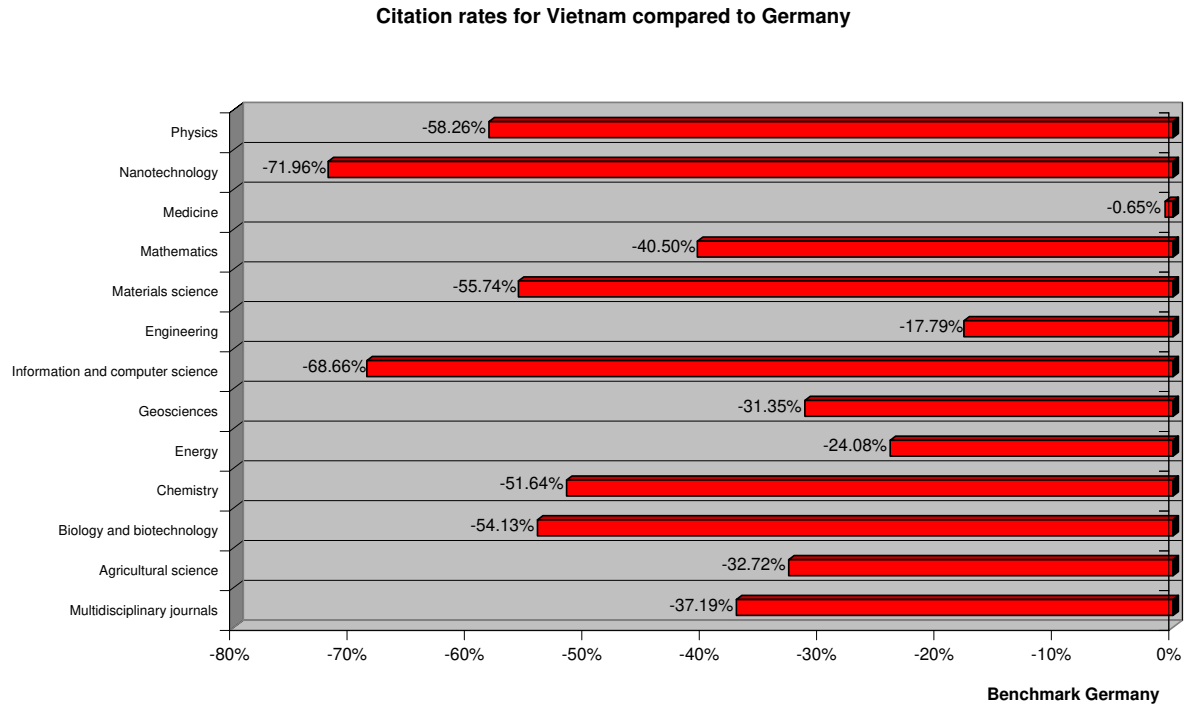

Figure 99(b): Citation rates for Vietnam compared to the selected benchmark Germany

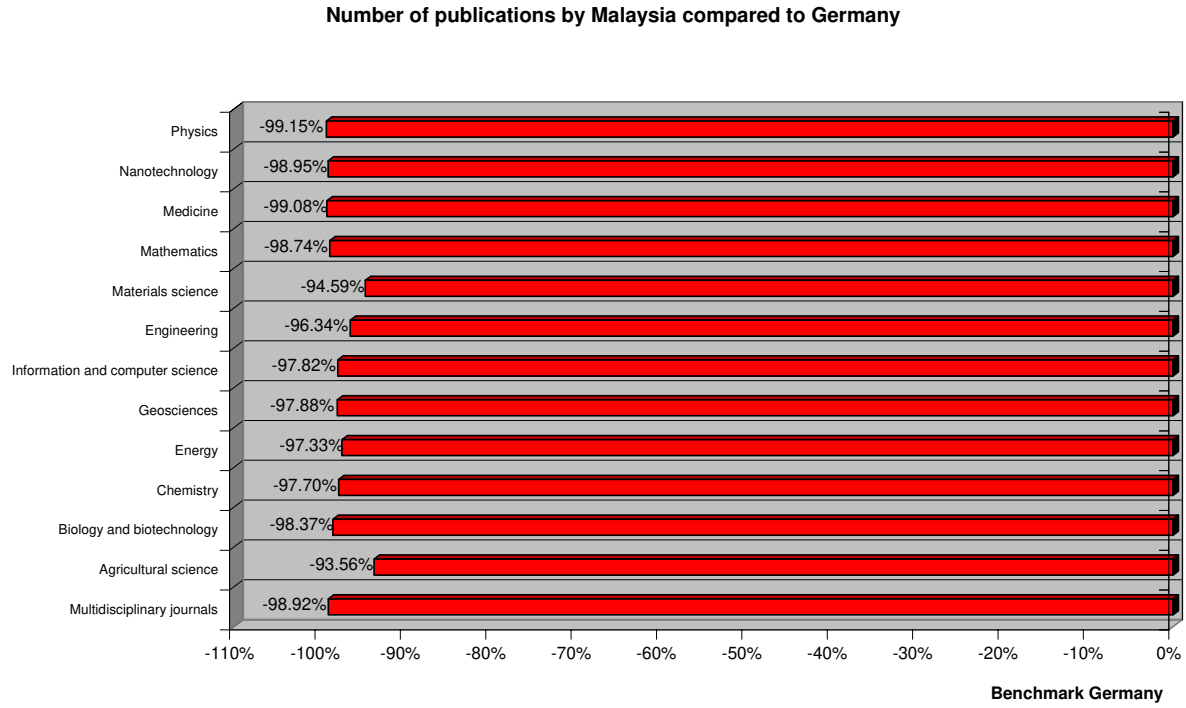

Figure 100(a): Number of publications by Malaysia compared to the selected benchmark Germany

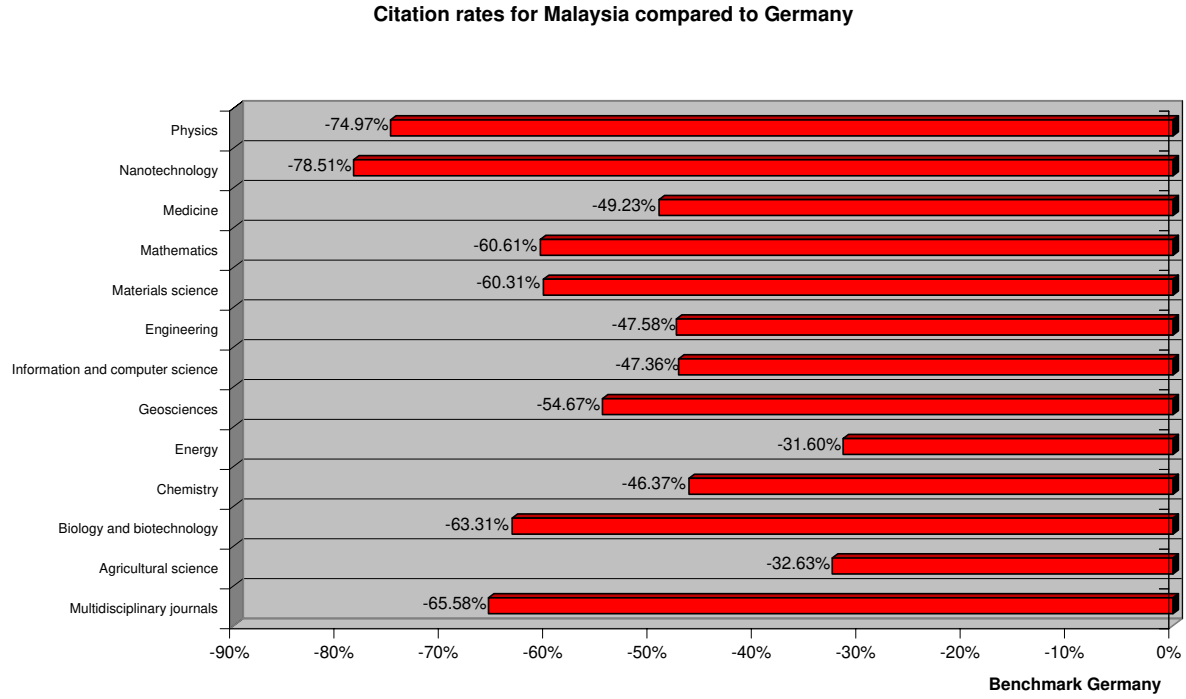

Figure 100(b): Citation rates for Malaysia compared to the selected benchmark Germany

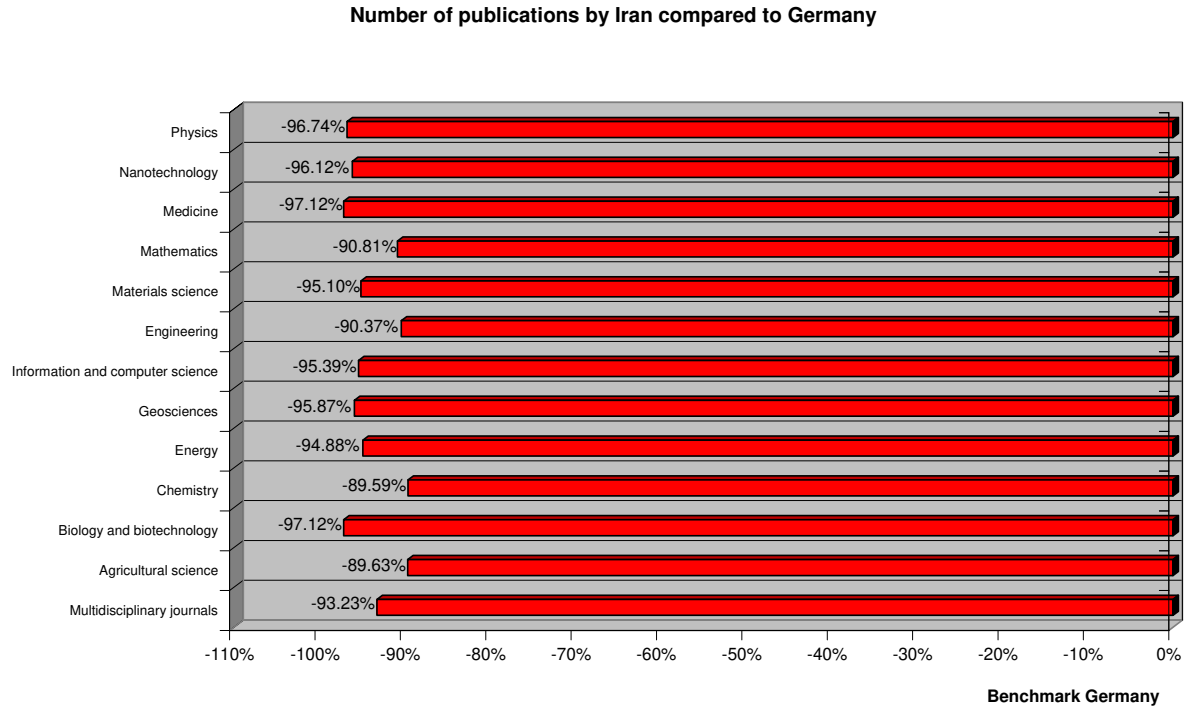

Figure 101(a): Number of publications by Iran compared to the selected benchmark Germany

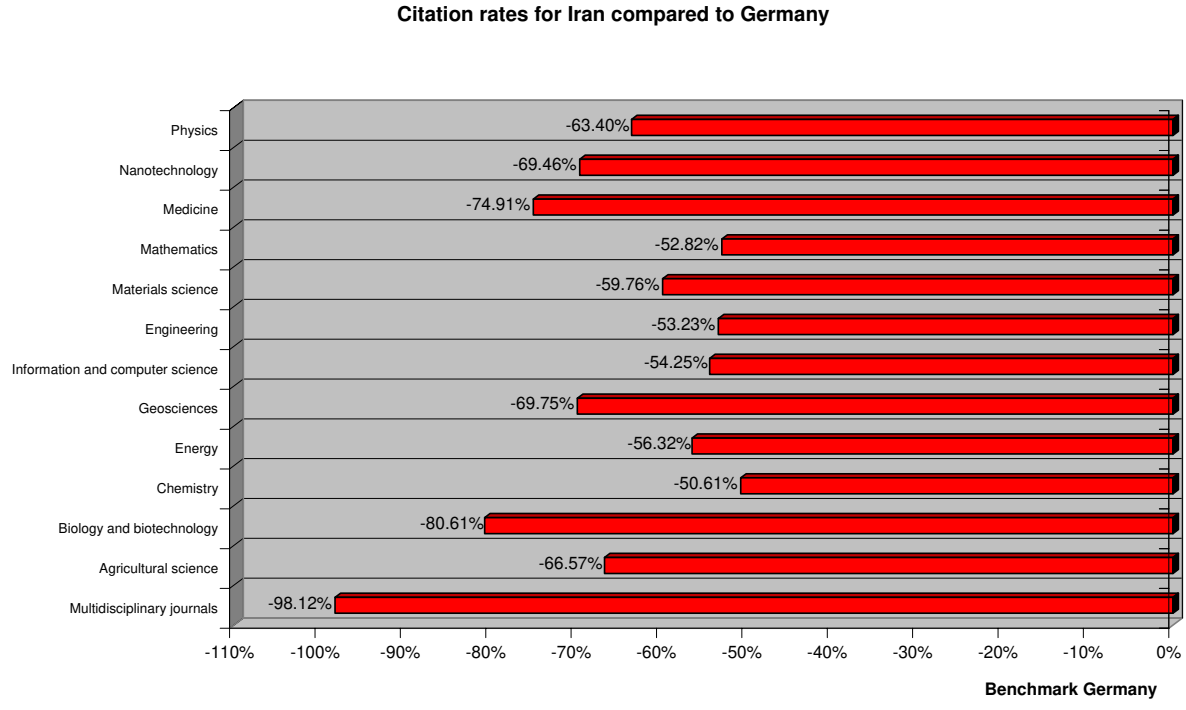

Figure 101(b): Citation rates for Iran compared to the selected benchmark Germany

3.4 Discipline-Specific Profiles of the Publication Output and its Perception

This section compares the discipline-specific publication behaviour of the South-East Asian countries as well as the perception of these publications. In contrast to the preceding chapters, the benchmark here is a global reference. All research articles and reviews published in 2007 are the basis of this analysis.
Not all disciplines are equally represented in the Science Citation Index. As illustrated by the graphic below, around one third of all publications in the database are in the area of medicine, while only around 4 % of the publications are in mathematics.

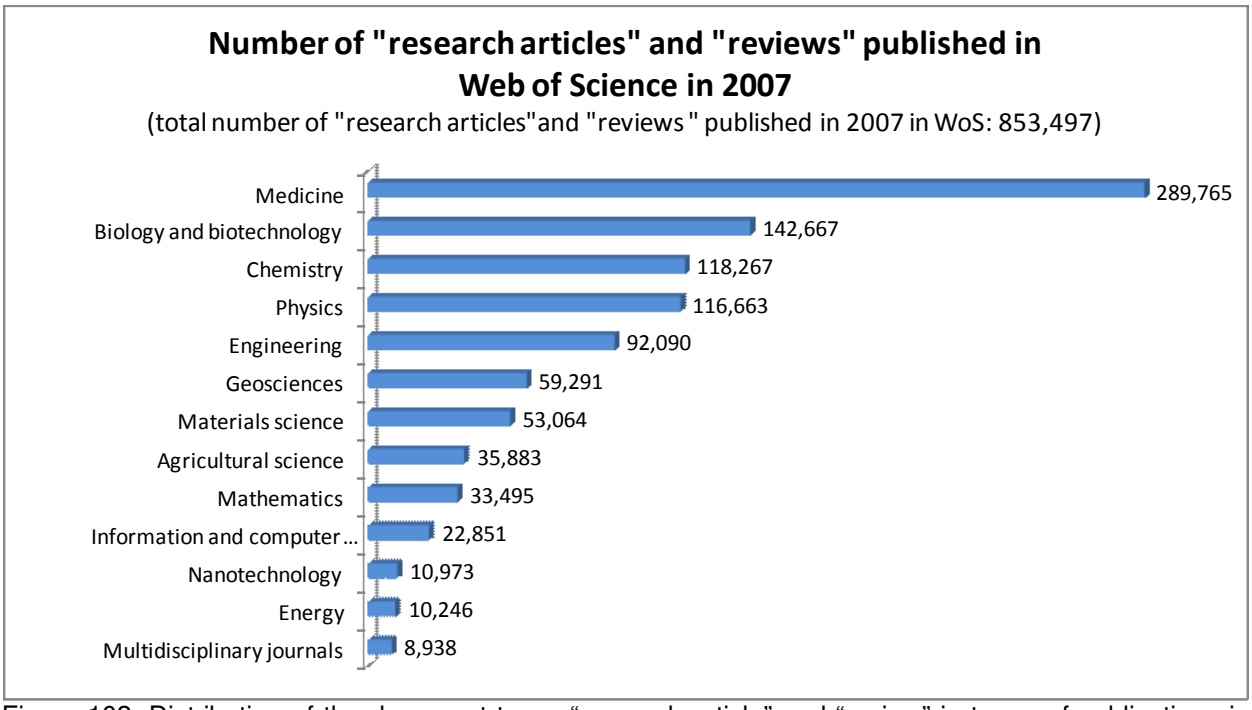

Figure 102: Distribution of the document types “research article” and “review” in terms of publications in the Web of Science in individual disciplines.

The unequal publication distribution is due to the fact that the disciplines have different communication behaviour. For this reason, sound bibliometric analyses must be conducted on a discipline-by-discipline basis. The global reference excludes possible distortions that could be implicit in another benchmark (e.g. comparisons with Germany).

The following network diagrams illustrate the share of publications published by a particular country in a particular discipline in 2007 as research articles and reviews in the journals included in the Web of Science in relation to the entire database. For example, in 2007, China published 20 % of the global output included in the Web of Science in the subject category “chemistry”. It should be noted that the percentage values cannot be added up because the sum of all countries is more than 100 % due to co-publications.

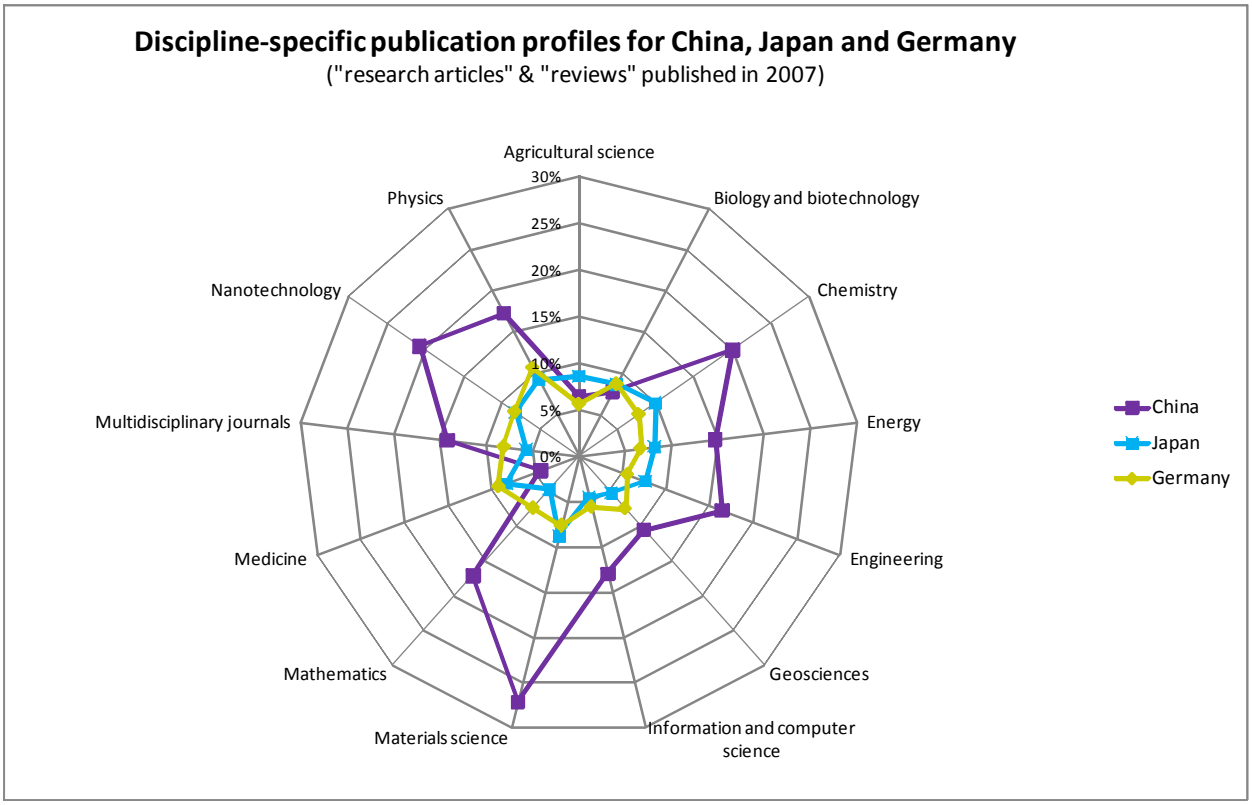

Figure 103: Discipline-specific publication profiles for China, Japan and Germany

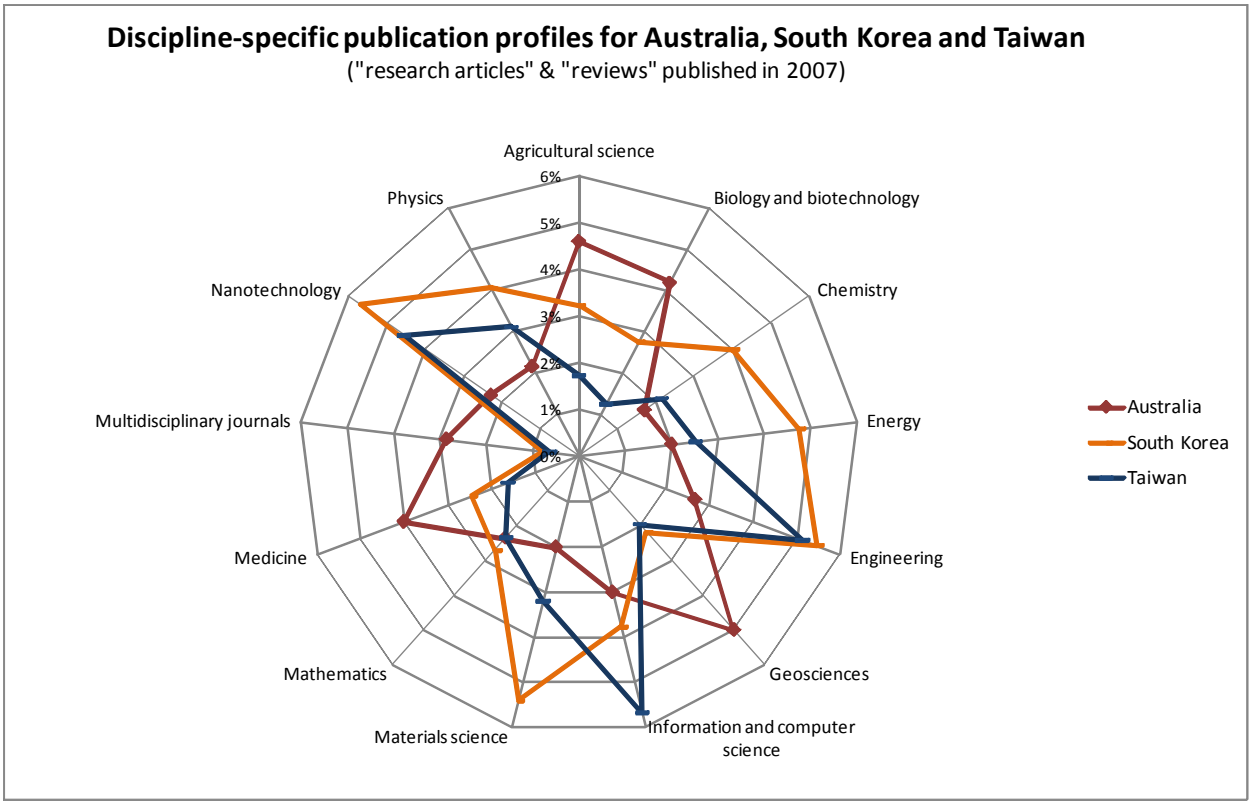

Figure 104: Discipline-specific publication profiles for Australia, South Korea and Taiwan

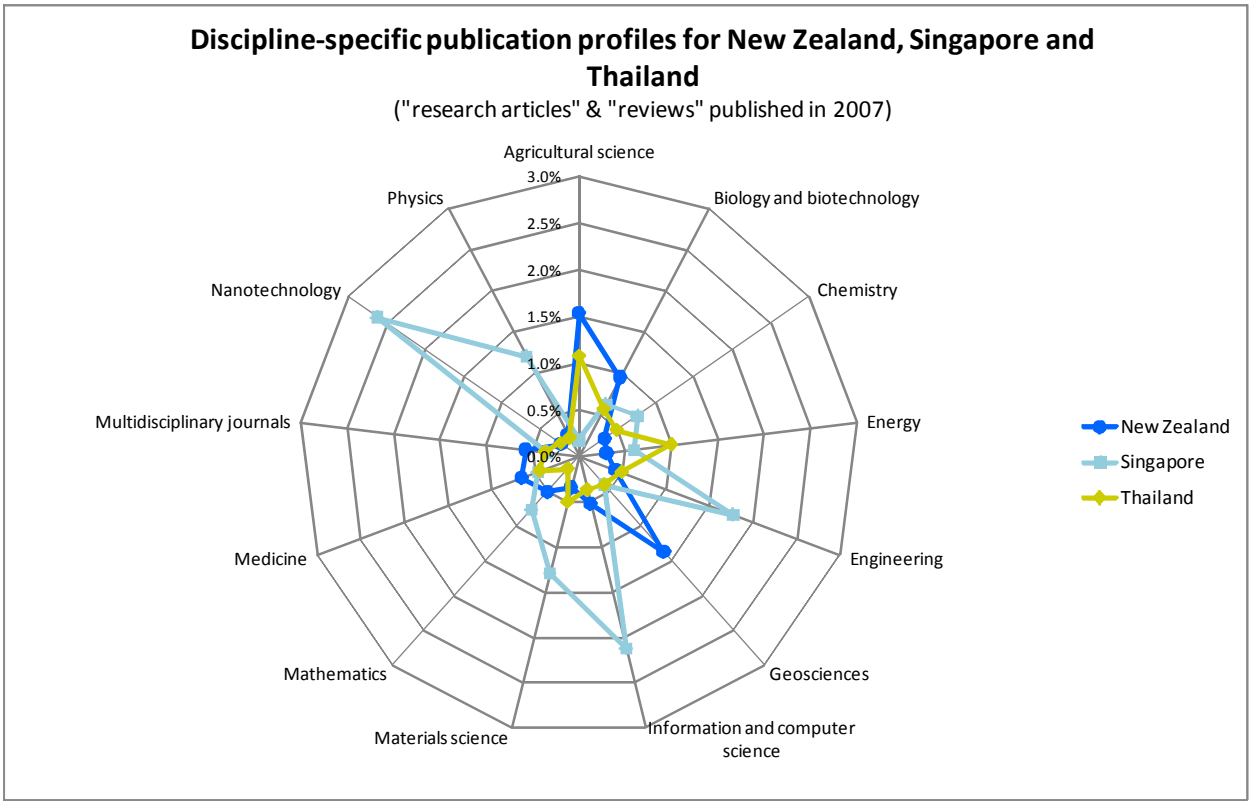

Figure 105: Discipline-specific publication profiles for New Zealand, Singapore and Thailand

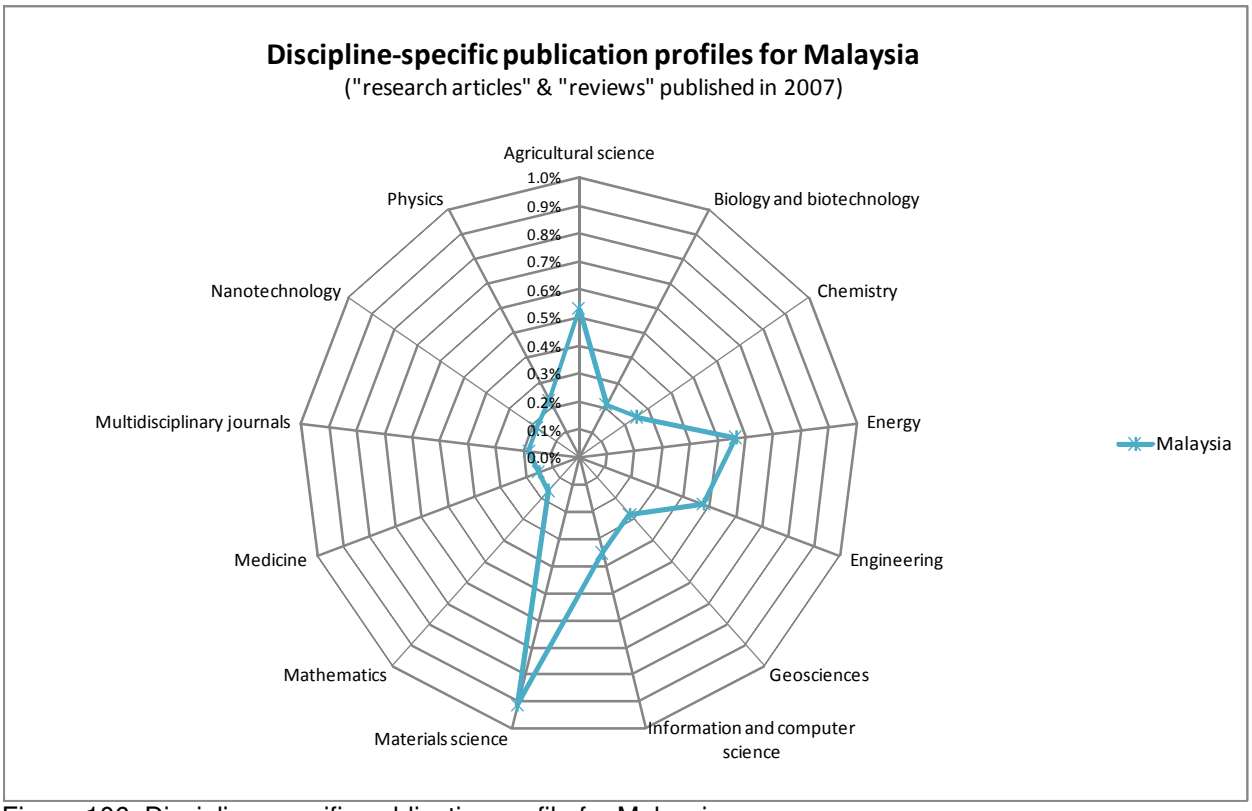

Figure 106: Discipline-specific publication profile for Malaysia

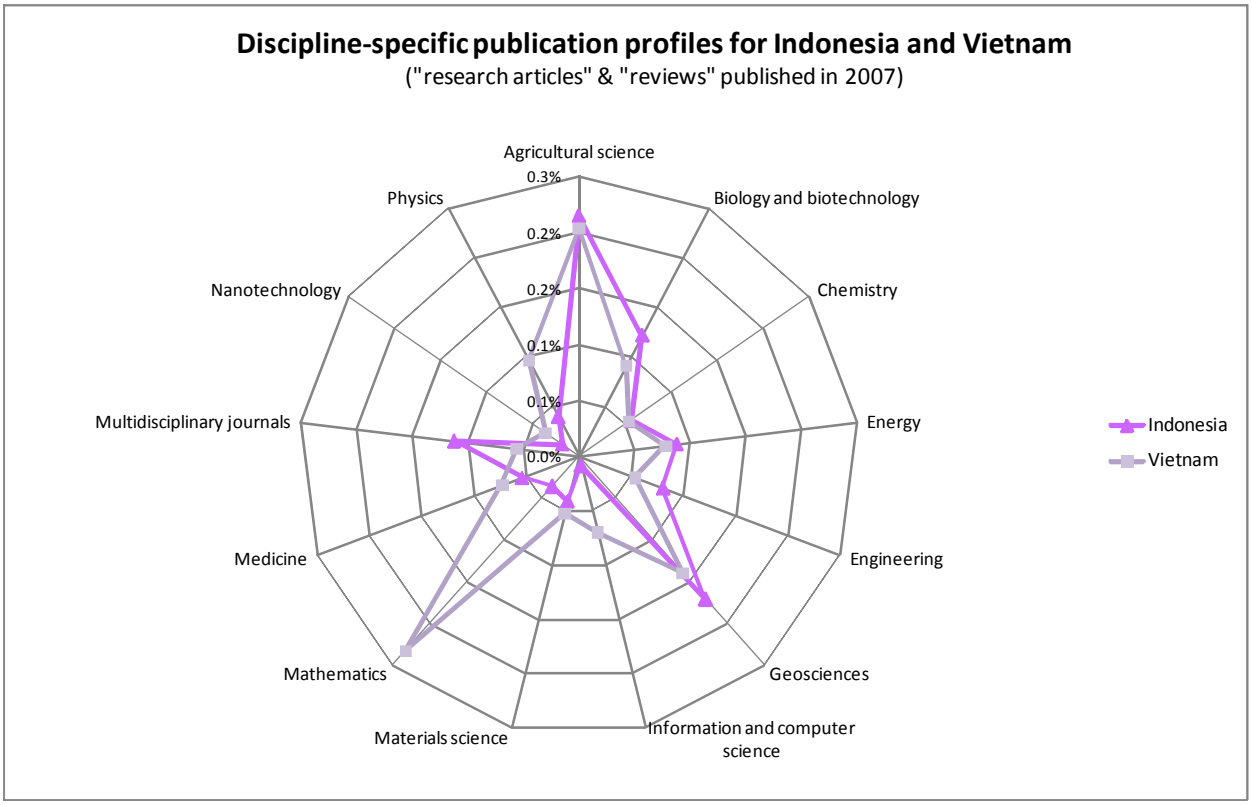

Figure 107: Discipline-specific publication profiles for Indonesia and Vietnam

The network diagrams reveal that the smaller countries have many peaks in their publication output in the various disciplines, while the larger countries tend to have circular curves. This can be explained by the fact that the smaller countries usually specialise in individual disciplines, while the larger countries tend to be equally represented in all disciplines.

A global reference is not just essential in creating publication profiles but also in the normalisation of the citation rate. This allows a global citation rate to be calculated for each discipline studied. The citation rate of a country in a discipline can then be measured in relation to the global citation rate in order to assess the performance of the country.

In the following network diagrams, the percentages are given for each country in each discipline. A value of 100 % corresponds to the global average. Values above or below 100 % lie above or below the average citation rate in a discipline, respectively. This reveals that China is below the global average perception in almost all disciplines.

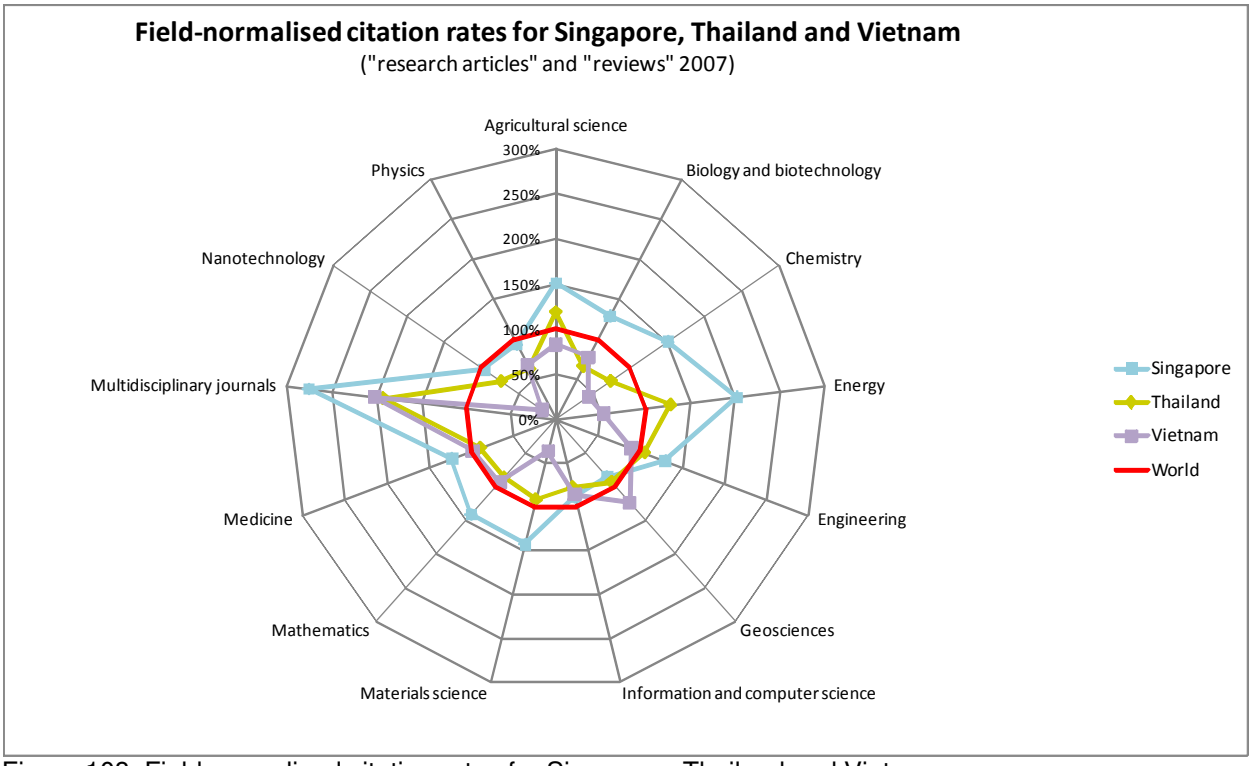

Figure 108: Field-normalised citation rates for Singapore, Thailand and Vietnam

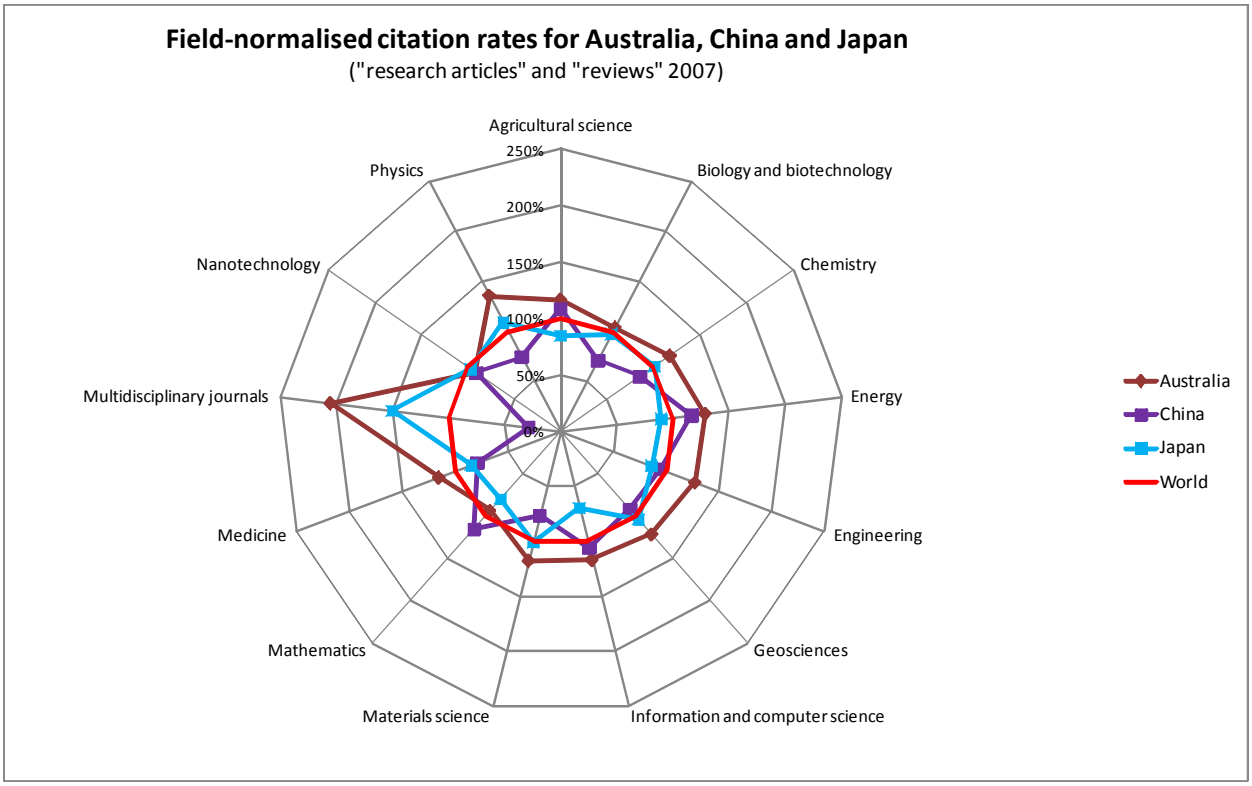

Figure 109: Field-normalised citation rates for Australia, China and Japan

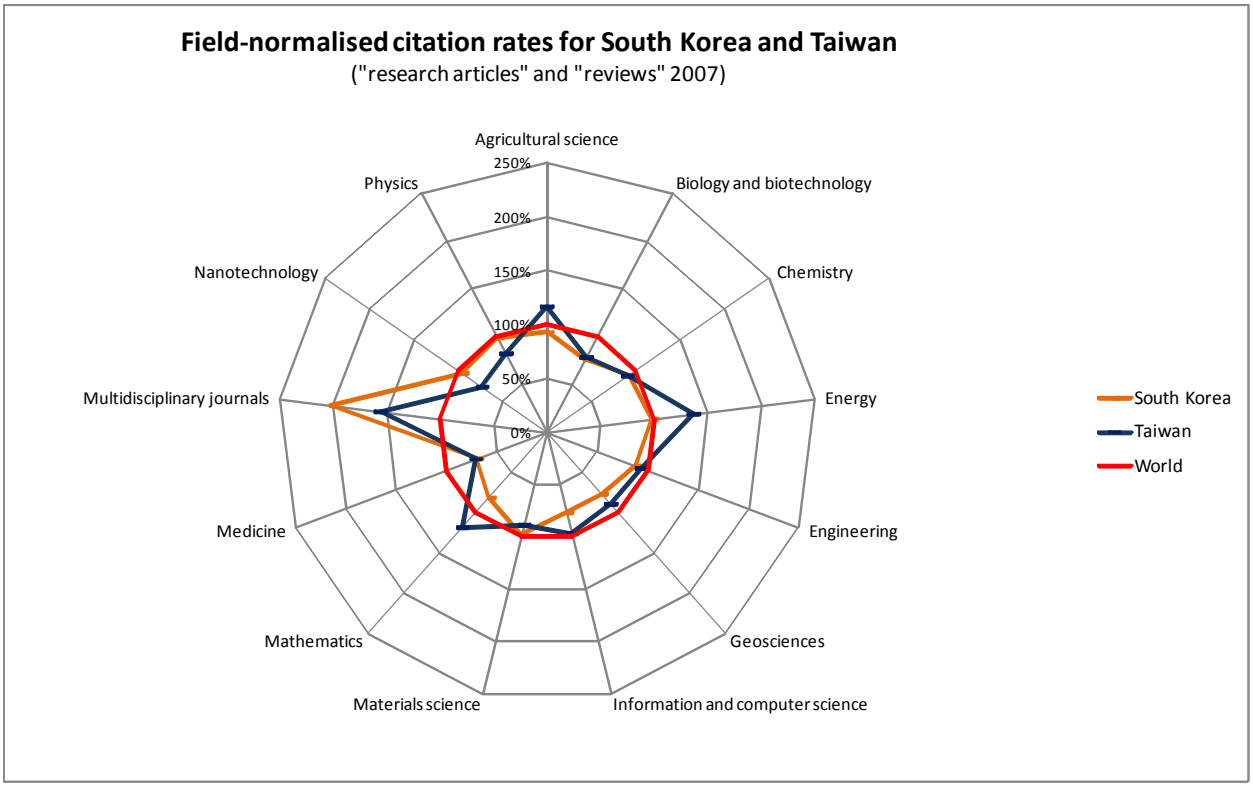

Figure 110: Field-normalised citation rates for South Korea and Taiwan

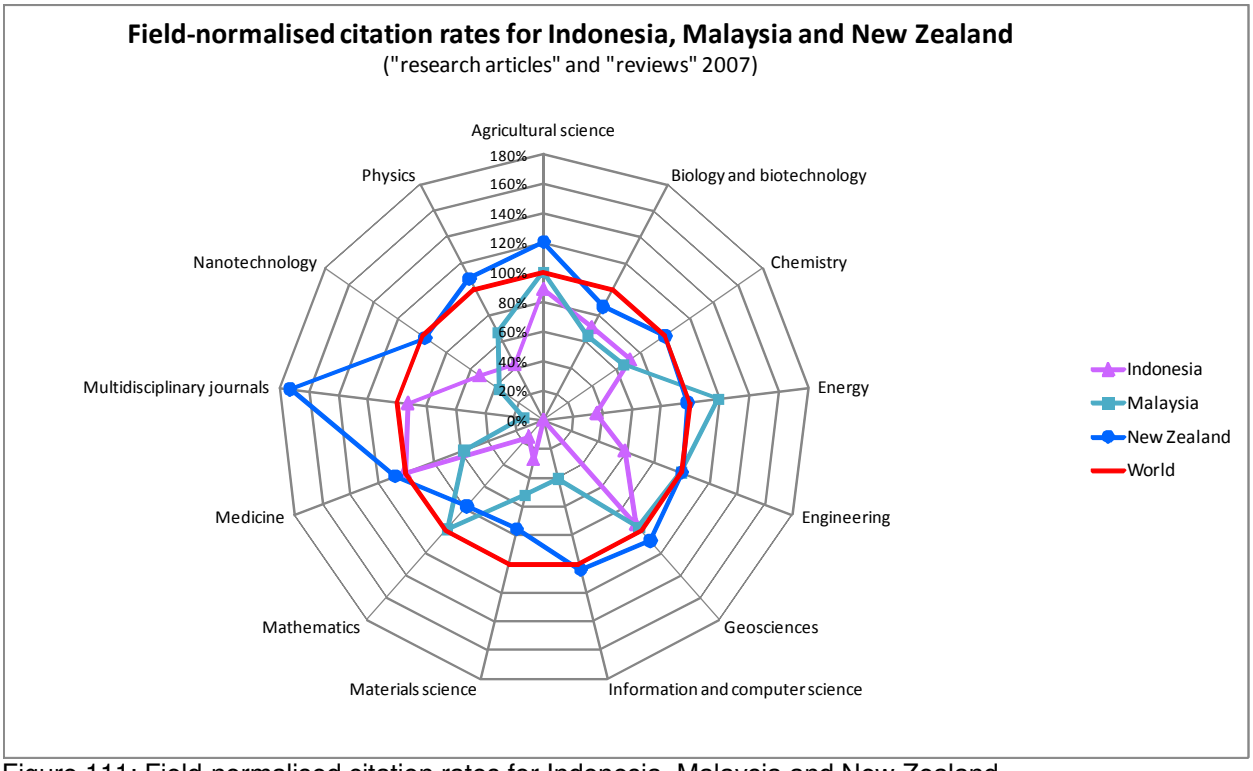

Figure 111: Field-normalised citation rates for Indonesia, Malaysia and New Zealand

4. Network Analysis

In the last chapter of this study, network analyses based on the data gathered previously are used to discuss one of the central questions of this study: how has scientific cooperation developed between the countries studied in South-East Asia? Have cooperations intensified above the average?

	1998		2007	
	Total output	**inc. collaborative papers with countries in South-East Asia**	**Total output**	**inc. collaborative papers with countries in South-East Asia**
South-East Asian countries	153834		292516	
Australia	26228	1376	39580	4114
China	21104	1737	99728	7835
Indonesia	402	128	819	358
Japan	78514	2374	89714	6322
Malaysia	850	134	2404	583
New Zealand	5284	522	7505	1272
Singapore	2995	335	7774	1729
South Korea	11893	766	33701	2767
Taiwan	9615	590	21233	2177
Thailand	1179	219	4255	974
Vietnam	253	54	855	286

Table 7: Total output of the countries and number of collaborative papers with at least one of the other countries in South-East Asia for the period 1998 – 2007

Table 7 shows how many publications were published by each country between 1998 and 2007 and how many of these articles are collaborative papers with at least one of the other countries studied. It we add up the output of each of the countries, we get a value that is larger than the total output of the South-East Asian countries (153,834 and 292,516 publications, respectively) because co-publications by the countries analysed are counted more than once.

The percentage of the total output of the South-East Asian countries shown in Table 8 reflect how often a country in the region studied publishes in collaboration with at least one other country in this region. This value reflects the cooperations within the network of South-East Asian countries. It is revealed that countries with a low publication output generate a large proportion of their scientific output in cooperation with other countries in the region studied. The opposite is also true, namely that countries with very large publication numbers are involved to a much smaller extent in joint publications.

	1998		2007	
	Share of total output of South-East Asian countries	Share of publications with at least one other South-East Asian country in relation to a country's total output	Share of total output of South-East Asian countries	Share of publications with at least one other South-East Asian country in relation to a country's total output
Australia	17.05%	5.25%	13.53%	10.39%
China	13.72%	8.23%	34.09%	7.86%
Indonesia	0.26%	31.84%	0.28%	43.71%
Japan	51.04%	3.02%	30.67%	7.05%
Malaysia	0.55%	15.76%	0.82%	24.25%
New Zealand	3.43%	9.88%	2.57%	16.95%
Singapore	1.95%	11.19%	2.66%	22.24%
South Korea	7.73%	6.44%	11.52%	8.21%
Taiwan	6.25%	6.14%	7.26%	10.25%
Thailand	0.77%	18.58%	1.45%	22.89%
Vietnam	0.16%	21.34%	0.29%	33.45%

Table 8: Publications by a country as a percentage of the total output of South-East Asian countries and percentage of the articles produced together with at least one other South-East Asian country (1998 and 2007)

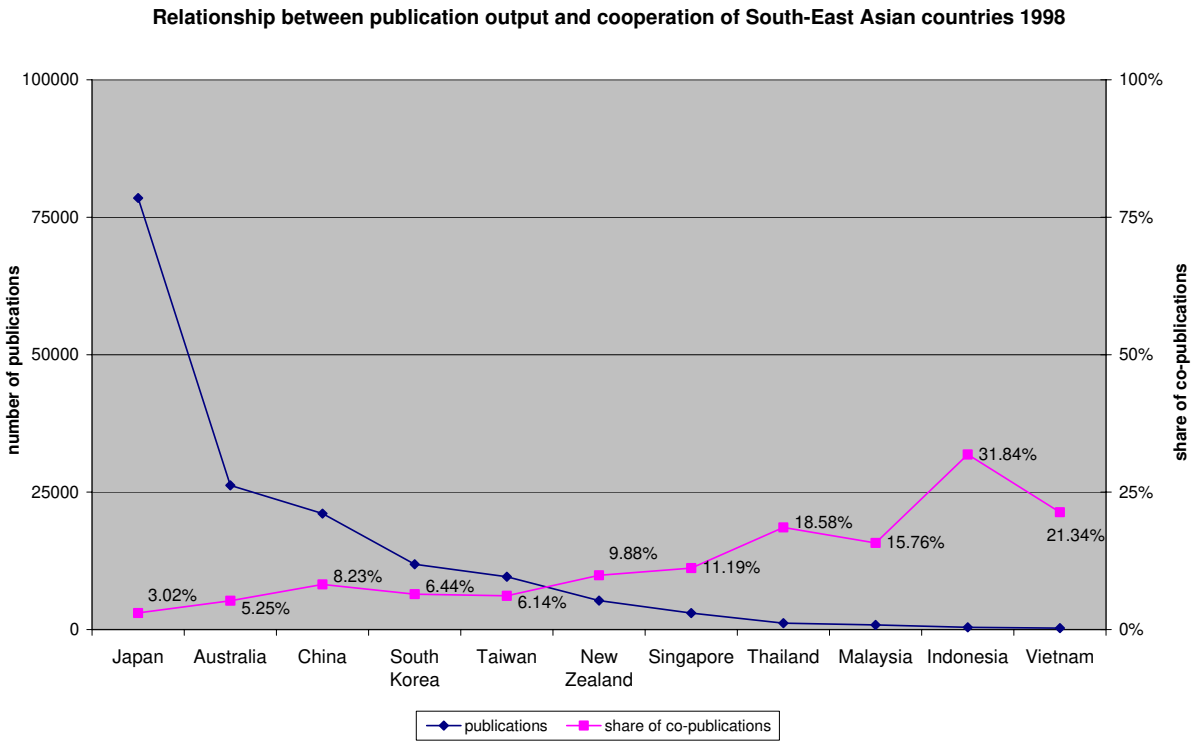

Figure 112: Relationship between publication output and cooperations in South-East Asia 1998

Figure 112 compares the publication output and the proportion of publications produced in cooperation with at least one other South-East Asian country (i.e. at least two of the eleven countries studied were listed in the authors' addresses). Indonesia tops the list: almost one third

of all Indonesian publications in 1998 were produced within the research area analysed. Indonesia's most important cooperation partners are Japan, Australia and Thailand. Its most important international partner is the USA. Germany features as its forth most important international partner. With 402 publications, Indonesia has the second lowest scientific output within the research area studied; Vietnam has the lowest. With 78,514 published journal articles, Japan, in contrast, was well ahead of all other countries in South Asia in 1998. However, only 3 % of its total output was published in cooperation with one of the other countries. The most important partners for Japanese scientists came from the USA, Germany and the United Kingdom. In forth place, China features as the first South-East Asian cooperation partner. In seventh and eight place are South Korea and Australia. As can be seen from the share of the total output of South-East Asian countries in Table 8, Japan was responsible for more than half of the publications in the region with its high publication output in 1998. Australia and China follow with 17 % and 13 %, respectively. Ten years later, this relationship changed: thanks to its almost exponential increase in publications, China became the most important country studied with 34 %. Japan, New Zealand and Australia lost some of their influence to all of the other countries analysed. Despite this, cooperation between these countries and the other countries excluding China increased disproportionately in relation to the total publication output. The drop of 4.55 % in China's share of publications by South-East Asia in the countries' total output compared to 1998 can be explained by a huge increase in the number of publications. Between 1998 and 2007, the number of Chinese publications increased by around 370 %. Co-publications with the other South-East Asian countries increased from 1,737 to 7,835, representing an increase of 350 %. China therefore cooperated less in relation to its total output in 2007 than it did with the research area in 1998. This statement must be considered in relation to China's total output and its exponential increase.

	Increase between 1998 and 2007	
	Development of the share of total output of the South-East Asian countries	**Development of the share of publications with one of the other countries studied in relation to the total output of a country**
Australia	-20.64%	98.12%
China	148.52%	-4.55%
Indonesia	7.14%	37.28%
Japan	-39.91%	133.06%
Malaysia	48.74%	53.83%
New Zealand	-25.31%	71.57%
Singapore	36.51%	98.84%
South Korea	49.02%	27.48%
Taiwan	16.14%	67.09%
Thailand	89.80%	23.23%
Vietnam	77.72%	56.72%

Table 9: Development of the share of publications by country in relation to the total output of the countries studied and the share of co-publications with one of the other countries analysed

If we compare Figures 112 and 113, which depict the behaviour of the publication output and the percentage of South-East Asian co-publications in relation to the total output of a country, it becomes clear that networking between the countries studied continues to develop in opposition to the publication output. All countries do not only publish more in absolute terms but they have also increased their share of cooperations with one of the other countries analysed. Indonesia remains the country with the highest number of co-publications in South-East Asia publishing almost half of its articles together with at least one of the other countries studied. As the countries with a low publication output generate a high share of their articles in cooperations

within South-East Asia, we can conclude that there is a high degree of dependency on a possible research area. The cooperation figures of developed countries, such as Japan and Australia, also experience a significant increase. As a result, we can speak of increasing cooperation in South-East Asia.

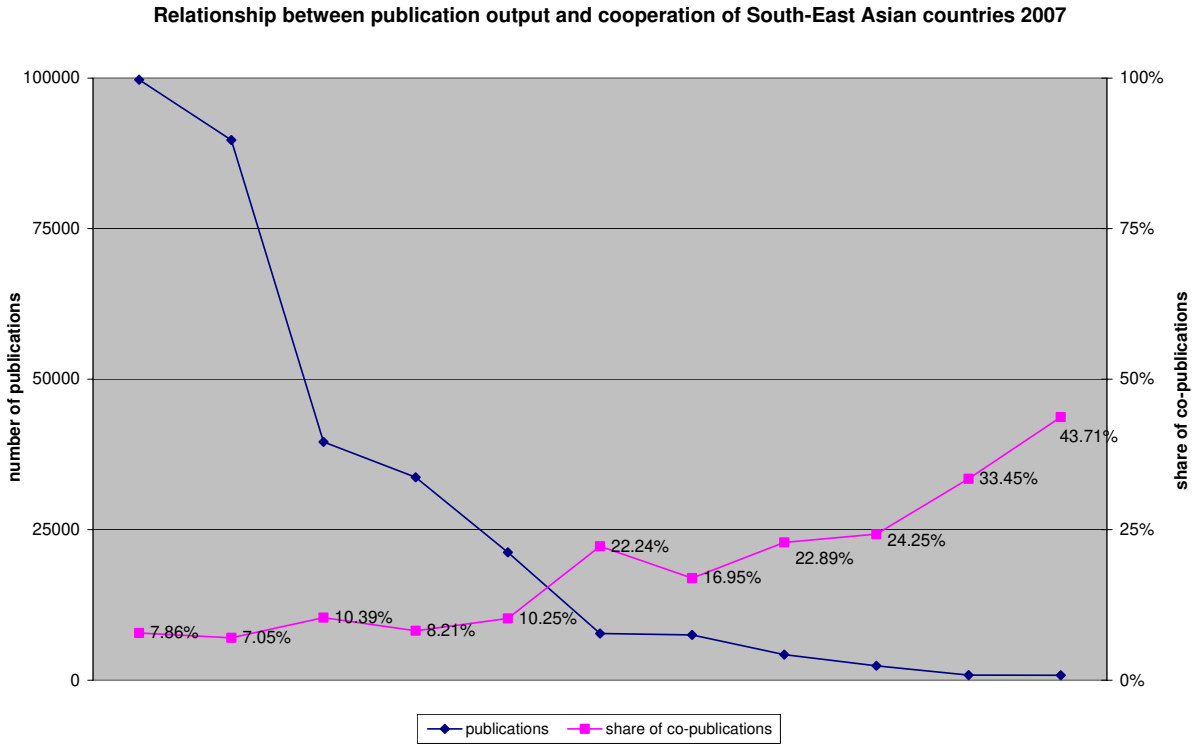

Figure 113: Relationship between publication output and cooperations in South-East Asia 2007

The network diagrams in Figures 114 to 117 clearly illustrate increasing networking between the countries studied for the period 1998 – 2007. Figures 114 and 115 show the development of the co-published journal articles between 1998 and 2007 in the form of network diagrams. The co-publications are indicated by the lines joining the dots representing the countries. The thicker the line, the greater the number of co-publications. The joint co-publications are relativised with respect to the output of the country. Salton's measure of international collaboration strength (S) was applied. This measures the strength of networking activities between two countries x and y, and relativises this strength to the size of the output of the two countries. This value is calculated by dividing the number of joint co-publications of two countries (C_{xy}) by the root of the product of the total publications of country x (C_x) and country y(C_y).

$$S_{xy} = \frac{C_{xy}}{\sqrt{C_x \cdot C_y}}$$

The diagrams in Figures 114 and 115 show that networking among the countries has increased perceptibly between 1998 and 2007. Since the co-publications have been relativised with respect to the total output of a country, the extreme increase in joint publications cannot be explained by the general rise in scientific output within these ten years. On the contrary, cooperation in the form of scientific networking within the research area studied has increased at a disproportionate rate and the network has become denser.

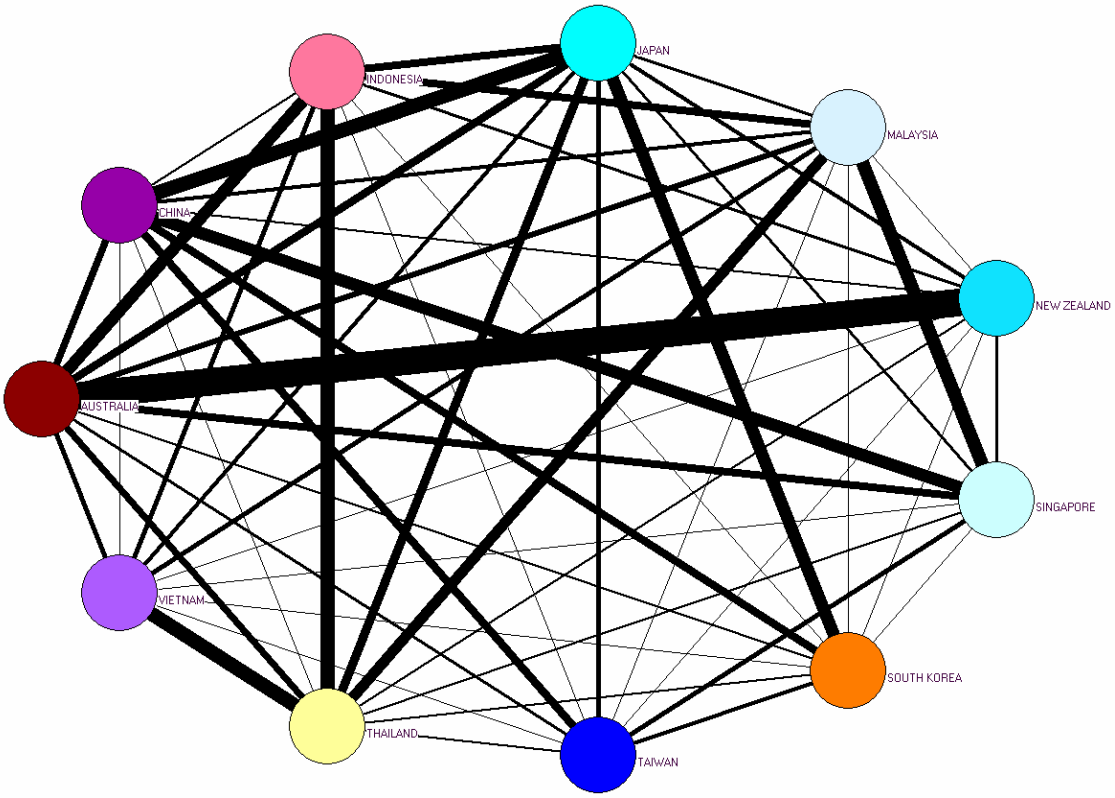

Figure 114: Co-publication network 1998 relativised using Salton's *international collaboration strength*

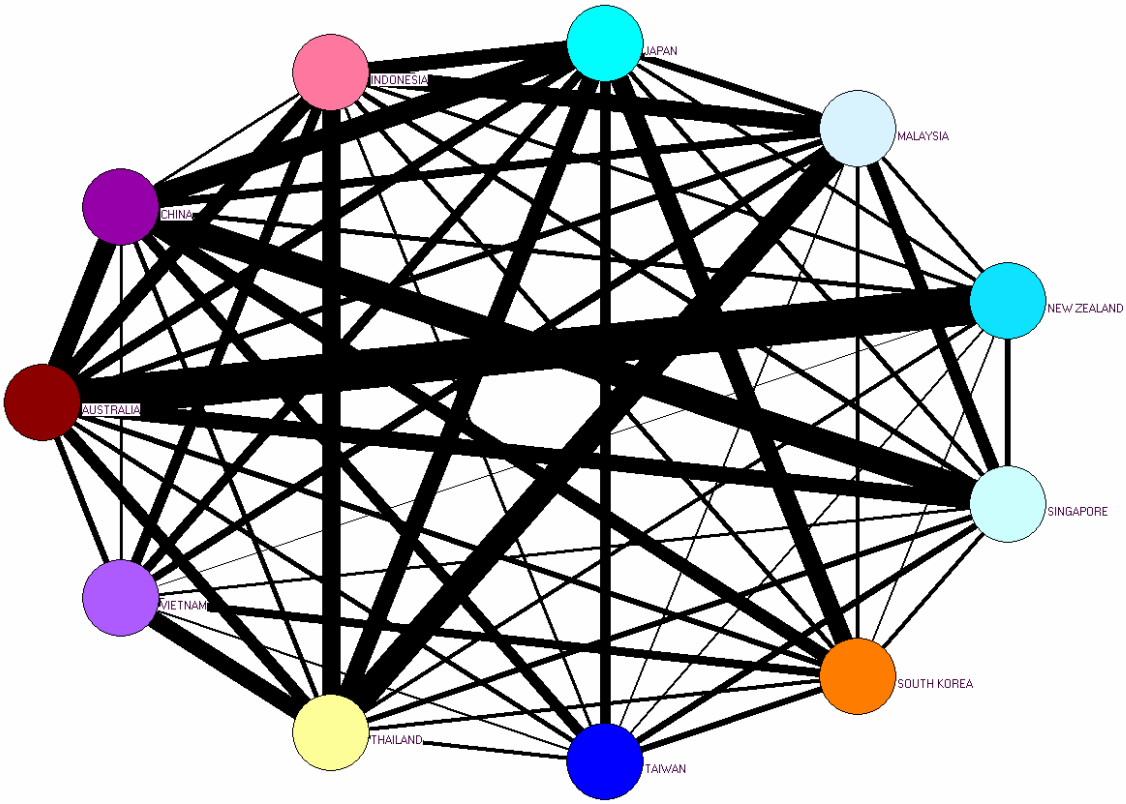

Figure 115: Co-publication network 2007 relativised using Salton's *international collaboration strength*

Figures 116 and 117 show the international co-publications by the eleven countries. In 1998, the countries analysed published with 140 countries throughout the world; ten years later, they were involved in scientific cooperations with 169 countries. The network diagrams therefore have 151 and 180 dots representing the countries, respectively. The strength of the connections between the dots reflects how intense cooperation between the different countries actually is. The more joint publications, the thicker the lines between the country dots. The general position of the countries reflects their importance in the network: If a country dot is central, then this country cooperates in networks with many other countries. The closer the dots are in the centre, the more pronounced their connections with each other.

When 1998 and 2007 are compared, it becomes clear that the South-East Asian countries have drawn closer together. This is reflected by the fact that networks within the research area have increased. This trend also verifies the above-mentioned growth rates. The density of the networks between these countries and those outside the area studied also increased between 1998 and 2007. This cannot be explained by the overall increase in publications as the number of co-publications was relativised with respect to the output of each country. Moreover, another trend also becomes visible: scientific publications are increasingly being published by a number of authors – including those in different countries. Pronounced networks with countries outside the research area analysed include those with the USA, the United Kingdom, Germany, France and the Netherlands.

The analysis of network diagrams clearly reveals that networks within the region analysed are becoming more intense and that cooperations with countries outside this research area are being dismantled.

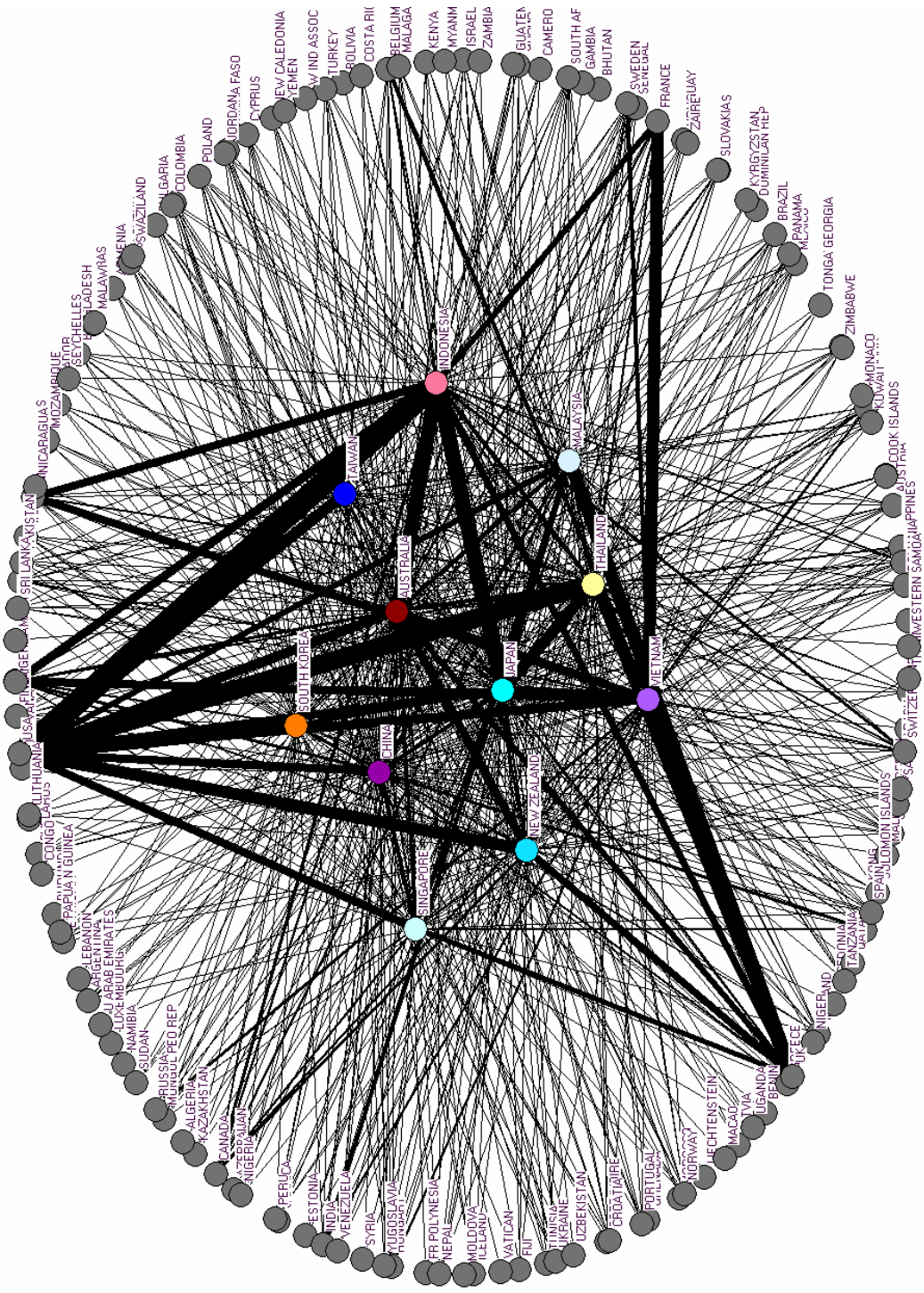

Figure 116: International co-publications of the countries analysed in 1998, relativised with respect to the publication output of each country

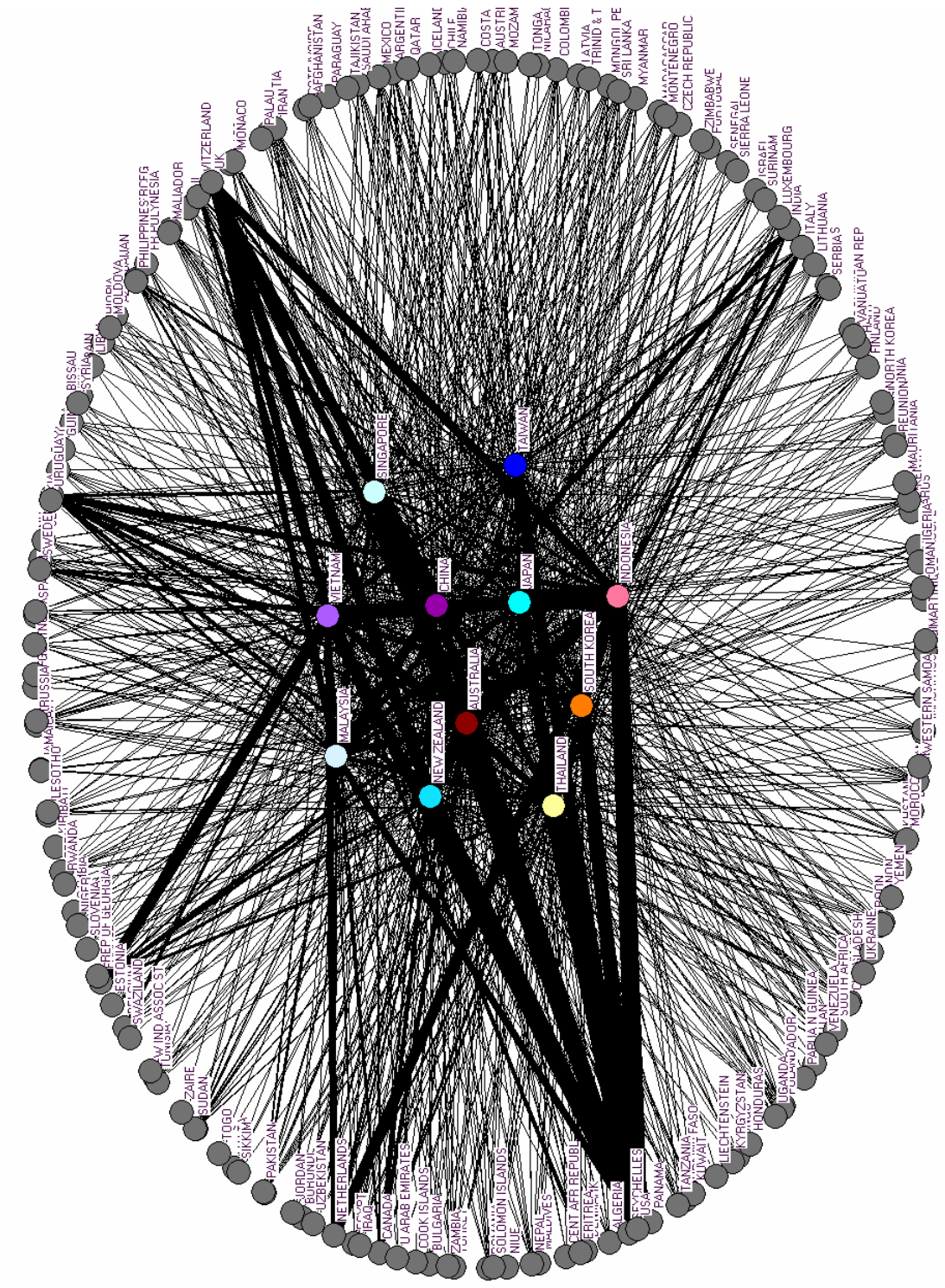

Figure 117: International co-publications of the countries analysed in 2007, relativised with respect to the publication output of each country

With the aid of a network analysis, we studied the output of South-East Asian countries (both between the countries studied and with others outside this area) and illustrated the results in the form of a network diagram. Using Salton's measure, a normalisation was performed. The results of these investigations allow us to draw the conclusion that cooperation between the countries studied has intensified in the period from 1998 to 2007 and that an Asia-Pacific research area has emerged. This conclusion is based solely on the bibliometric analyses performed in this study and must be supplemented with more results before it can be generalised.

A counter example, in which ten selected countries with the same bibliometric parameters are investigated in the same manner as the South-East Asian countries, should furthermore prove that increasing networking activities within the research area investigated cannot be explained by a general global increase in international cooperations nor are they simply a matter of coincidence.

Verification of networks using randomly selected countries

In the preceding investigation, different analysis methods revealed that cooperation between the key countries increased disproportionately between 1998 and 2007. To conclude that the proportion of international co-publications has generally increased worldwide, the same method will be applied in the following to a counter sample of ten[9] selected countries[10]. Figure 118 shows the annual number of scientific publications by the selected comparative countries between 1992 and 2007. Germany and Japan, which have already been analysed in relation to South-East Asia, once again come out way ahead of the other countries. France and Russia follow in third place. In the case of Russia, the drop in the number of scientific papers must be considered in the context of the political collapse. Excluding Russia, the publication output of all countries investigated increased between 1992 and 2007.

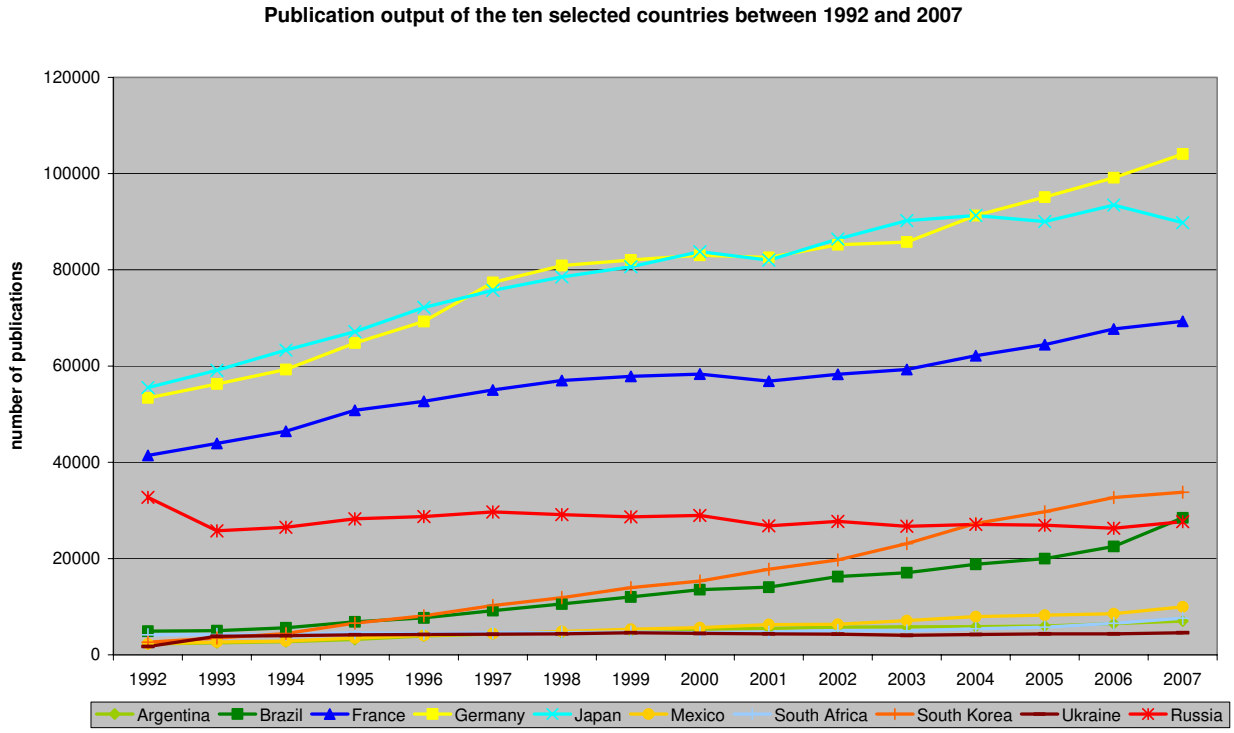

Figure 118: Publication output of the ten selected countries between 1992 and 2007

[9] The countries chosen are: Argentina, Brazil, Germany, France, Japan, Mexico, South Africa, South Korea, Ukraine and Russia.

[10] The selection was made based on the following criteria: both small and large countries (measured in terms of publication output), countries from South-East Asia, as well as countries with and without geographical relationships.

	1998		2007	
	Total output	**inc. collaborative papers with one of the other selected comparative countries**	**Total output**	**inc. collaborative papers with one of the other selected comparative countries**
Selected countries	274810		357203	
Germany	80902	6640	104928	10565
Japan	78514	3020	90682	5089
South Korea	11898	877	34172	2329
Brazil	10580	1179	28478	2133
Mexico	4856	534	9969	1048
South Africa	4620	309	7616	780
France	57000	4954	69298	9044
Russia	29129	3733	27688	4639
Ukraine	4378	765	4601	1133
Argentina	4559	490	7001	1138

Table 10: Total output of the countries and number of collaborative papers with at least one of the other comparative countries for the period 1998 – 2007

Table 10 shows the total output of the selected countries for the period 1998 to 2007 and the number of articles published by these countries in cooperation with at least one of the other selected countries. Table 11 contains these values as percentages. In 1998, Ukraine and Russia published the most within this community of countries. While these figures were around 17 % and 13 % for the selected comparative countries, they were well above this in South-East Asia: approx. 32 % for Indonesia, approx. 21 % for Thailand and approx. 19 % for Vietnam. Furthermore, as shown in Figures 119 and 120, no clear relationship was found between the publication output of a country and cooperation with one of the randomly selected countries. Although the share of jointly published articles increased in the case of seven of the ten randomly selected countries between 1998 and 2007 (see Table 12), the figures for the South-East Asian countries increased even more significantly. Taken together, the selected comparative countries published a total of 273,810 scientific journal articles in 1998 and 357,203 in 2007.

	1998		2007	
	Share of total output of selected comparative countries	Share of publications with at least one other selected country in relation to a country's total output	Share of total output of selected comparative countries	Share of publications with at least one other selected country in relation to a country's total output
Germany	29.44%	8.21%	29.37%	10.07%
Japan	28.57%	3.85%	25.39%	5.61%
South Korea	4.33%	7.37%	9.57%	6.82%
Brazil	3.85%	11.14%	7.97%	7.49%
Mexico	1.77%	11.00%	2.79%	10.51%
South Africa	1.68%	6.69%	2.13%	10.24%
France	20.74%	8.69%	19.40%	13.05%
Russia	10.60%	12.82%	7.75%	16.75%
Ukraine	1.59%	17.47%	1.29%	24.63%
Argentina	1.66%	10.75%	1.96%	16.25%

Table 11: Publications by a country as a percentage of the total output of the selected countries and share of the articles produced with at least one other selected country (1998 and 2007)

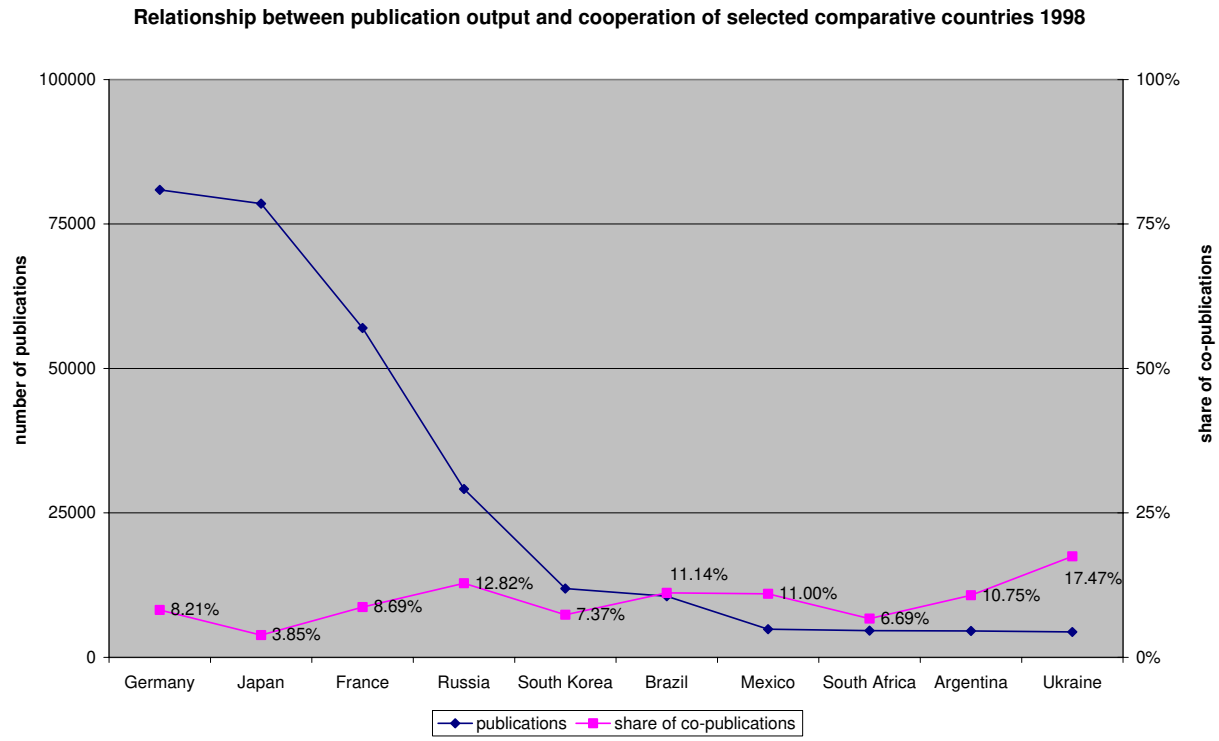

Figure 119: Relationship between publication output and cooperation in the selected comparative countries 1998

	Growth	
	Development of the share of total output of selected comparative countries	**Development of the share of publications with one of the other selected comparative countries in relation to the total output of a country**
Germany	-0.22%	22.68%
Japan	-11.14%	45.90%
South Korea	120.96%	-7.54%
Brazil	107.08%	-32.79%
Mexico	57.94%	-4.40%
South Africa	26.82%	53.13%
France	-6.47%	50.16%
Russia	-26.87%	30.74%
Ukraine	-19.15%	40.93%
Argentina	18.14%	51.24%

Table 12: Development of the share of publications by country in relation to the total output of the selected countries and the share of co-publications with one of the other selected comparative countries

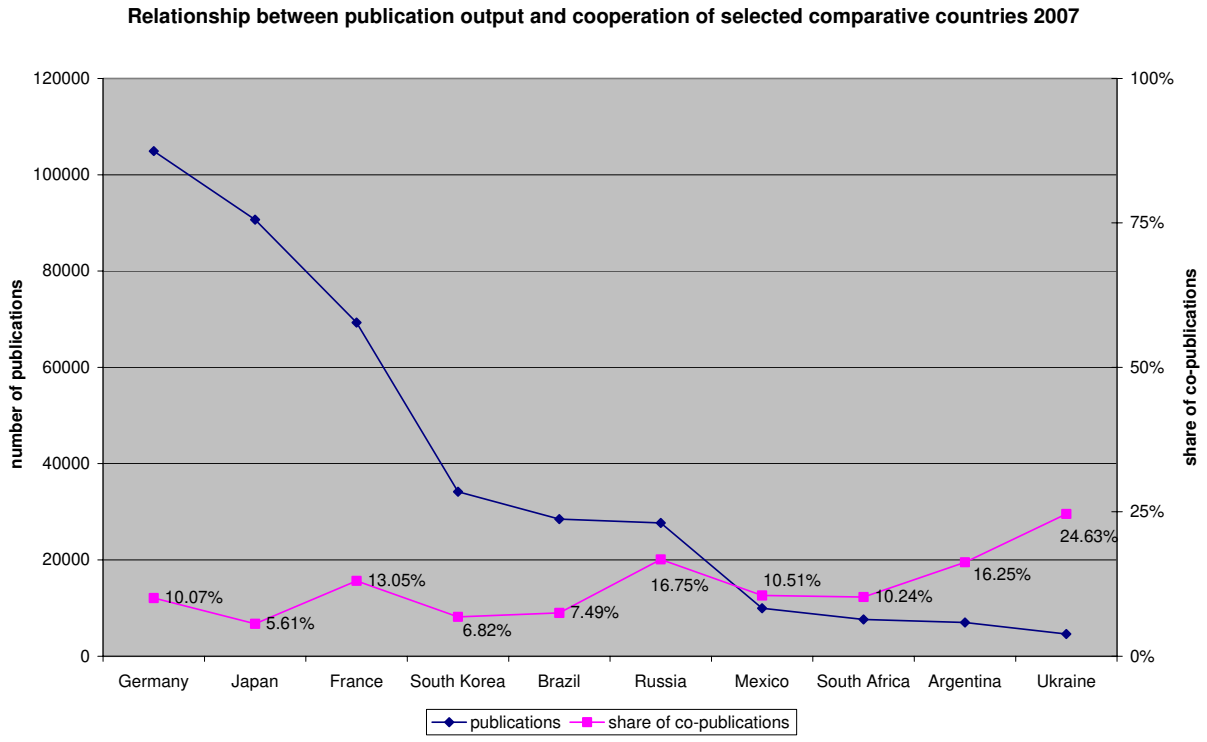

Figure 120: Relationship between publication output and cooperation in the selected comparative countries 2007

The network diagrams in Figures 121 and 122 clearly show that the number of jointly published journal articles increased between 1998 and 2007. As the number of co-publications by two countries has been relativised in relation to the countries' output using Salton's measure of *international collaboration strength*, the increase in the number of articles published in cooperation with another country cannot be explained by a general increase in the number of publications over the ten years studied here. A clear increase can therefore be ascertained in international scientific cooperation between 1998 and 2007.

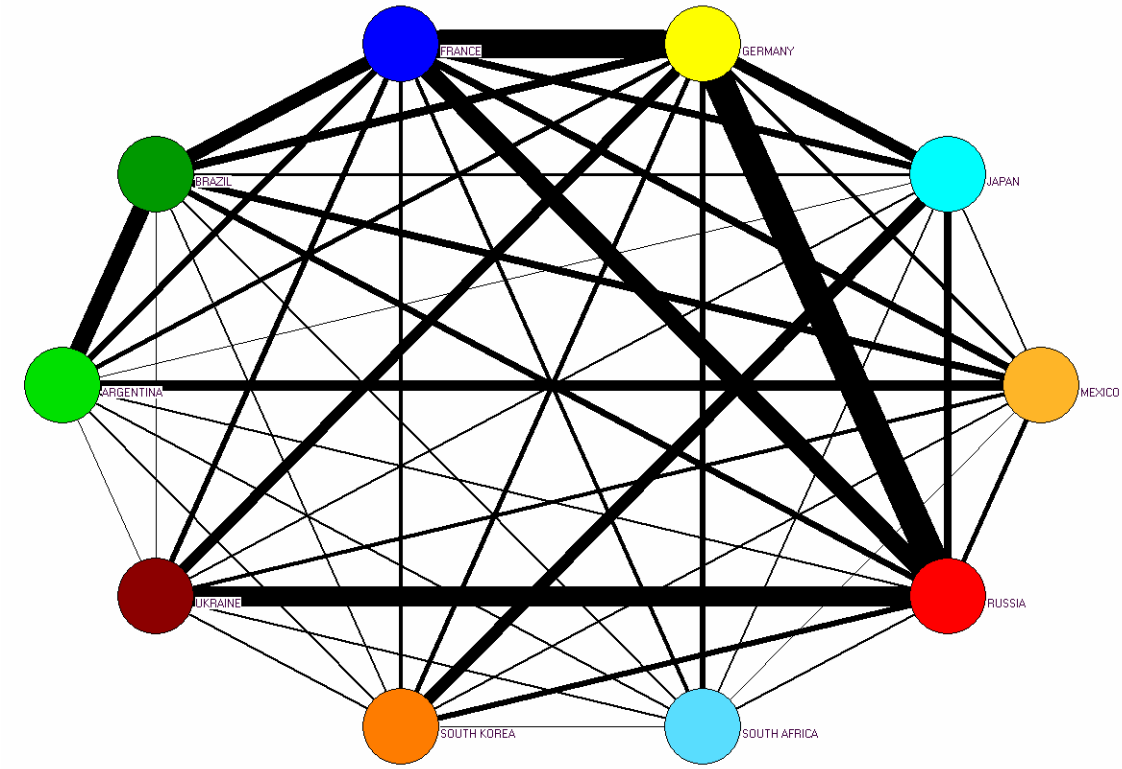

Figure 121: Co-publications of the randomly selected countries in 1998 relativised using Salton's measure of *international collaboration strength*

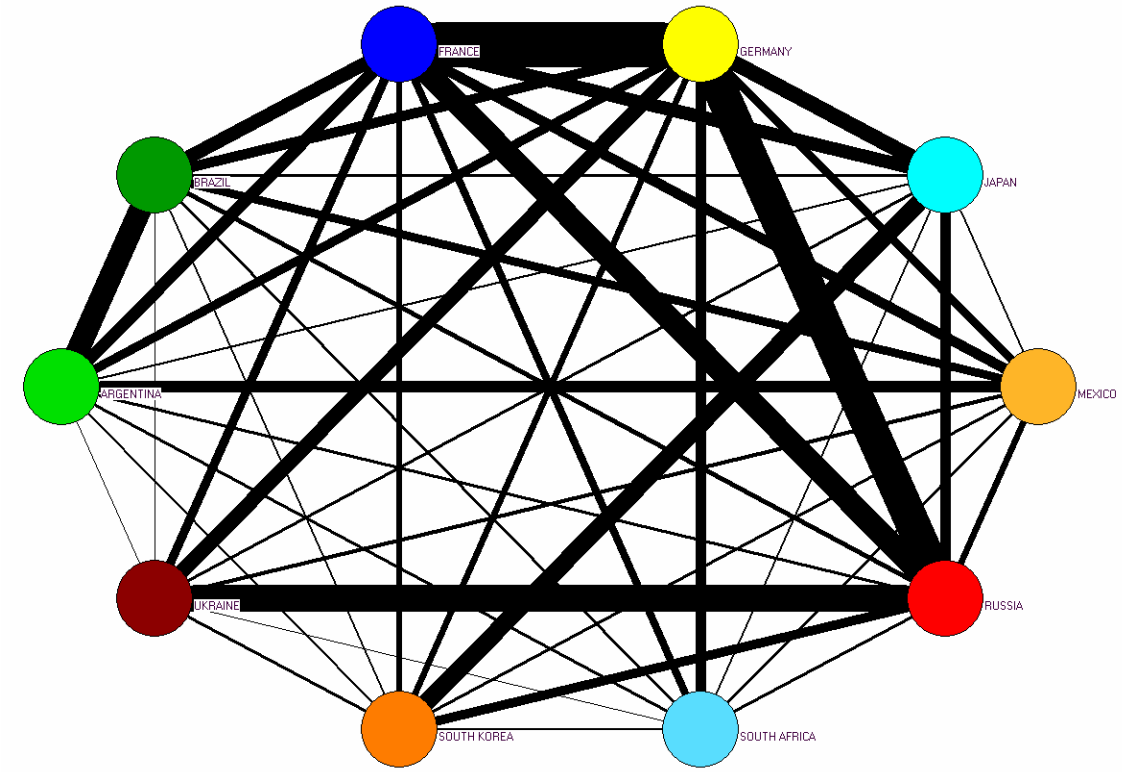

Figure 122: Co-publications of the randomly selected countries in 2007 relativised using Salton's measure of *international collaboration strength*

If we compare the development of South-East Asia and the community of selected comparative countries, it becomes clear that the increase in cooperations between South-East Asian

countries is much larger than in the case of the ten selected countries. In the case of the countries in South-East Asia, the network as a whole becomes much denser in 2007. In the case of the network of selected comparative countries, the relationships between the countries have only become denser for countries in the same geographical region: a pronounced increase was determined between France and Germany, Argentina and Brazil, Japan and South Korea, and Ukraine and Russia. The increase in ties between Russia and France and Germany, however, cannot be explained geographically. A role is probably played by the fact that Russia was the only country whose output decreased between 1998 and 2007.

Comparing the networks reveals that the international cooperation between countries within a research area is much stronger than between selected countries. We can therefore conclude that an Asian-Pacific research area has emerged from a bibliometric perspective within the last ten years. By adding further data and information from the scientific environment of these countries, this conclusion based on bibliometric data can be used to evaluate whether a research area that is not just based on the evaluation of scientific publications has actually developed between the countries.