

# Exploration of the Bibliometric Coordinates for the Field of ‘Geography’

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## Abstract

This study is a bibliometric analysis of a highly complex research discipline, namely geography, in order to identify the most used and cited publication channels, to reveal publication strategies, and to analyse the discipline’s coverage in the three main data sources for citation analyses: Web of Science, Scopus and Google Scholar. The results show very heterogeneous and individual publication strategies when considering the selection of adequate publication channels even in the same research fields. Monographs, journal articles (including proceedings papers) and book chapters are the most cited document types. Differences between research fields more related to the natural sciences than to the social sciences are clearly visible but not so considerable when taking into account the higher number of co-authors. General publication strategies are more established in the fields related to the natural sciences. Although an “iceberg citation model” is suggested, citation analyses for monographs, book chapters and reports (working papers) should be conducted separately and include complementary data sources, such as Google Scholar, in order to enhance the coverage and improve the quality of the citation analysis.

## Conference Topics

Citation and co-citation analysis – Social Sciences

## Introduction and background

From a bibliometric point of view, geography is a very challenging discipline, because it belongs to the natural sciences (geography, physical) as well as to the social sciences (geography), as it is clearly depicted in each edition of Journal Citation Reports (see Table 1).

**Table 1. Category data of geography in both Editions of JCR (2013)**

<i>JCR EDITION</i> <i>2013</i>	<i>Category</i>	<i>Total</i> <i>Cites</i>	<i>Median</i> <i>IF</i>	<i>Aggre</i> <i>gate</i> <i>IF</i>	<i>Aggre</i> <i>gate</i> <i>Imme</i> <i>diacy</i> <i>Index</i>	<i>Aggre</i> <i>gate</i> <i>Cited</i> <i>Half-</i> <i>Life</i>	<i>#</i> <i>Journals</i>	<i>#</i> <i>Articles</i>
Sciences	GEOGRAPHY, PHYSICAL	159297	2.152	2.574	0.72	7.5	46	4972
Social Sciences	GEOGRAPHY	79207	1.059	1.612	0.343	7.4	76	3762

Table 1 shows very different citation characteristics according to the corresponding JCR edition. Furthermore, geography is a highly interdisciplinary field, very strongly related to geosciences, environmental sciences, ecology and remote sensing (natural sciences), or to economics, urban studies and political sciences (social science), as a quick search and refine analysis in WoS (Web of Sciences - core collection) illustrates.

Although there are many studies illustrating the differences between natural and social sciences and the different publication cultures depending on the discipline (e.g. Nederhof, 2006; Australian Research Council, 2012; Ossenblok et al., 2012; van Leeuwen, 2013; Moksony, 2014), no literature focusing on this specific could be retrieved by the authors.

The main research questions of this study are:

- What are the publication characteristics depending on the different research field?
- Can differences be observed concerning research fields? What is their time evolution?

- Which are the most used publication channels? Which document types are the most cited ones? Is it possible to identify publication strategies?
- What is the coverage in the three main citation data sources, Web of Science, Scopus and Google Scholar? Could Google Scholar be used as a complementary data source?

### **Data sources and methodology**

This study is primarily based on publication data collected for three professorial appointments at the University of Vienna (Department for Geography): the first one, related to Geosciences and comprising of twelve candidates, and the second one, related to Social and Economic Geography and comprising of ten candidates, were performed during 2013. The third one, related to Demography and comprising of nine candidates, was performed in August 2014.

All the publication data were delivered directly by the applicants, whose identity has to remain anonymous. All bibliometric indicators added to the list of publications by the authors themselves, such as citation counts, impact factor or the h-index, were controlled or recalculated in order to enable a correct and comparable analysis (Gorraiz, J. & Gumpenberger, C., 2015). Document types used by the authors in their list of publications were manually reassigned to the following standard groups: Monographs (Books), Book chapters, Journal articles, Proceedings Papers, Conferences (including meeting abstracts and talks), Reports (Working Papers), Book Reviews, Edited Books and Journals Issues, and other publications (or Miscellaneous). A clear distinction between “Proceedings Papers” and “Conferences” was not always possible when relying on the lists of publications.

The main data source for coverage and citation analyses was Web of Science - Core Collection (WoS) including the Conference Proceedings and Book Citation Index. Since coverage in the usual multidisciplinary bibliographic and citation databases (Web of Science, Scopus) is very low and unsatisfactory for citation analyses, we have included Google Scholar (GS) as an additional data source in a first explorative attempt (Jacso, 2005; Kousha & Thelwall, 2007; Meho, & Yang, 2007; Gorraiz et al., 2013).

The analysis in GS was performed by using the Google Scholar Citation Profiles (applicants for the third appointment were invited to create their individual profiles and make them publicly available for a couple of weeks) as well as by applying the tool ‘Publish or Perish’ particularly designed for this purpose.

In spite of the fact that citations were checked and the percentage of self-citations was determined, citation analyses in GS should be taken with a pinch of salt. Google Scholar is not a database but a search engine, and therefore indexing remains non-transparent and documentation is lacking. That is why the analyses were also performed in Web of Science, including the Cited Reference Search (which means considering citations originating from Web of Science (WoS) ‘core journals’ to all document types without any restrictions), and in Scopus.

Publication windows were the last ten years (general for all authors, appointments no.1 and 2) and the career length of each applicant (for all appointments). In order to distinguish individual scientific career lengths, the year of the first publication activity is always included.

The observed citations window was identical for all applicants per professorial appointment procedure. It covers the date from publication until April - May 2013 for appointments no. 1 and 2, and until July - August 2014 for appointment procedure no.3.

Visibility analyses were performed according to the data in the Journal Citation Reports (JCR), Science Edition 2012 (appointments no. 1&2).

The quartiles (Q1= top 25%; Q2= top 25-50%; Q3= top 50-75% and Q4= top 75-100%) were calculated according to the 2-years impact factor (IF) in the corresponding WoS category.

## Results

### *Comparison between appointments no.1 and no.2*

Table 2 and 3 show the most important publication document types used by the candidates for both appointments. The spectrum is much more heterogeneous in the social sciences, where journal articles are not always the most common publication channel.

**Table 2. Publication spectrum and WoS coverage according to provided publication list for appointment no.1 – Geosciences - 12 candidates. (In parenthesis, the number of document types indexed in WoS; PY=all years; \*no distinction).**

Candi date no.	1st Pub Year	Books	Edited Books/ Issues	Book Chapters	Proceedings & Conference Papers*	Book Reviews	Miscellaneous	Journal Articles (JA)
1	2004	1	0	5 (1)	14 (1)	0	3	28 (24)
2	2002	0	0	6 (1)	35 (3)	0	2	33 (30)
3	1996	13	7	12 (4)	26 (1)	0	0	38 (28)
4	1990	2	4 (2)	25 (6)	17	0	29	17 (11)
5	1998	4	2	1	6 (2)	0	65	75 (61)
6	1998	2	0	8 (2)	55 (2)	0	3	31 (21)
7	2007	4	0	1	41	0	1	35 (33)
8	1994	9	0	16	192	0	0	66 (53)
9	1999	0	0	7	13 (3)	0	5	28 (28)
10	2005	3	0	12	12(2)	10 (5)	10	18 (11)
11	2002	0	0	5 (1)	70	0	0	28 (18)
12	1994	1	0	2 (1)	8	0	1	51 (51)

**Table 3. Publication spectrum and WoS coverage according to provided publication list for appointment no. 2 - Social & Economic Geography - 10 candidates. (In parenthesis, the number of document types indexed in WoS; PY=all years; \*no distinction).**

Candi date no.	1st Pub Year	Books	Edited Books/ Issues	Book Chapters	Proceedings & Conference Papers*	Book Reviews	Miscellaneous	Journal Articles (JA)
1	1999	3	2	8 (1)	2	8	50	72 (35)
2	2002	3	11	21	5 +*56	0	0	16 (8)
3	1991	7	0	19(1)	*87	0	13	37 (18)
4	1993	3	0	17 (2)	*67	19(9)	44	46 (24)
5	1994	7	2	16	2 + *34	0	9	31 (17)
6	2005	3	5	15	*42	0	5	15 (4)
7	1990	3	11	58	4	10	14	35 (22)
8	2005	1	1	5	*40	0	9	20 (7)
9	2004	3 (1)	0	21 (7)	*10	2	10	16 (11)
10	2000	3	1	17	*72	0	49	22 (11)

Miscellaneous were principally Reports and Working Papers in both appointments. Therefore this document type was considered separately in the second part of the study.

In appointment no. 2, other document types such as Films, Policy Briefs, Newspapers and Special Issues were mentioned but only individually. For two candidates (one in appointment no.1 and one in no.2), articles in other (non-scientific or non-peer-reviewed) journals were also assigned to the group Miscellaneous.

Concerning the coverage in WoS both tables corroborate the low coverage of books and book chapters in both editions of the Book Citation Index. For articles in peer-reviewed journals, the WoS coverage in appointment no.1 varies between 60 and 100% and the trend in the last 10 years was constantly increasing until it reached a quota of almost 90% for all candidates. In appointment no. 2, the coverage was lower, varying between about 30 and 60%, but a similar trend was also observed even if not as steep.

Tables 4 and 5 show the results of the visibility (publication strategies) and citation analyses performed for both appointments. Only publications indexed in WoS in the last ten complete years (2003-2012) were considered.

**Table 4. Visibility (Q1 and %Q1) and citation analysis in WoS for appointment no. 1 – Geosciences - 12 candidates. (PY=2003 -2012, ARPP= Articles, Reviews & Proceedings Papers).**

Candi date no.	Ist Pub Year	Publications			# Authors per Paper	Citations ARPP			h-Index	% Self-citations	Q1	% Q1
		Total	ARPP	per Y		Sum	per P	Max				
1	2004	25	25	2.78	6.36	147	5.88	28	7	16.22%	16	69.57%
2	2002	28	28	2.80	4.93	181	6.46	36	7	24.31%	14	87.50%
3	1996	29	26	2.60	4.83	249	9.58	31	10	19.05%	14	53.85%
4	1990	11	7	0.70	2.73	29	4.14	21	3	12.50%	5	100.00%
5	1998	49	48	4.80	5.57	458	9.54	42	12	30.07%	34	72.34%
6	1998	18	18	1.80	3.72	180	10.00	44	7	7.78%	8	53.33%
7	2007	32	32	5.33	5.53	428	13.38	155	12	21.26%	20	62.50%
8	1994	31	29	2.90	5.06	598	21.36	110	15	7.18%	29	93.55%
9	1999	17	17	1.70	4.94	317	18.65	102	7	4.73%	6	42.86%
10	2005	16	11	1.38	2.94	40	3.64	24	3	10.00%	2	14.29%
11	2002	16	16	1.60	4.38	129	8.06	21	8	15.50%	9	60.00%
12	1994	36	26	2.60	4.69	294	11.31	44	12	17.06%	32	91.43%
	<b>Mean</b>	<b>25.67</b>	<b>23.583</b>	<b>2.582</b>	<b>4.64</b>	<b>254.2</b>	<b>10.166</b>	<b>54.8</b>	<b>8.583</b>	<b>15.47%</b>	<b>16</b>	<b>66.77%</b>

**Table 5. Visibility (Q1 and %Q1) and citation analysis in WoS for appointment no. 2 - Social & Economic Geography - 10 candidates. (PY=2003-2012; ARPP= Articles, Reviews & Proceedings Papers).**

Candi date no.	Ist Pub Year	Publications			# Authors per Paper	Citations ARPP			h-Index	% Self-citations	Q1	% Q1
		Total	ARPP	per Y		Sum	per P	Max				
1	1999	22	15	1.50	1.14	122	8.13	53	6	11.02%	12	60.00%
2	2002	7	4	0.40	2.00	22	5.50	10	3	9.09%	0	0.00%
3	1991	12	9	0.90	1.75	352	39.11	94	7	3.13%	9	81.82%
4	1993	23	12	1.20	2.61	134	11.167	76	6	13.41%	7	31.82%
5	1994	13	9	0.90	2.23	76	8.44	34	4	3.13%	3	23.08%
6	2005	4	3	0.38	1.00	3	1.00	2	1	0.00%	0	0.00%
7	1990	18	13	1.30	2	36	2.77	11	3	24.32%	3	18.75%
8	2005	7	6	0.75	2.57	48	8.00	17	4	8.33%	1	14.29%
9	2004	17	14	1.56	1.82	259	18.50	149	5	8.33%	7	70.00%
10	2000	8	7	0.70	1.13	53	7.57	40	3	9.26%	1	12.50%
	<b>Mean</b>	<b>13.1</b>	<b>9.2</b>	<b>0.958</b>	<b>1.82</b>	<b>110.5</b>	<b>11.02</b>	<b>48.6</b>	<b>4.2</b>	<b>9.00%</b>	<b>4.3</b>	<b>31.22%</b>

These results corroborate the higher number of publications and citations in the discipline related to the natural sciences (about twice as many). But taking into account the number of co-authors and the percentage of self-citations, which is almost twice as high in the natural sciences, there is not really a considerable difference.

The visibility analysis (number of Q1- journal articles) shows that publishing in top journals with impact factor, result in a much higher visibility in the appointment related to natural sciences than in the one related to the social sciences.

Finally, tables 6 and 7 show that the citation differences, according to the aggregate impact factor of the main WoS category, are higher in appointment no.1 than in no.2.

**Table 6. First and second research field according to WoS categories for appointment no. 1 - Geosciences – 12 candidates.**

<i>Candidate no.</i>	First Research Field (2003-2012)		Second Research Field (2003-2012)
	WoS Category	IF aggregate 2012	WoS Category
1	Ecology	3.095	Environmental Sciences
2	Remote Sensing	1.845	Geosciences, Multidisciplinary
3	Water Resources	1.803	Geosciences, Multidisciplinary
4	Water Resources	1.803	Geosciences, Multidisciplinary
5	Soil Science	1.780	Geosciences, Multidisciplinary
6	Ecology	3.095	Forestry / Soil Science/ Environm. Sci.
7	Ecology	3.095	Forestry / Plant Sciences
8	Geosciences, Multidisciplinary	2.176	Geography, Physical
9	Geosciences, Multidisciplinary	2.176	Geography/ Water Resources
10	Geography, Physical	2.206	Geography / Remote Sensing
11	Water Resources	1.803	Soil Sciences /Environmental Sci.
12	Geochemistry & Geophysics	1.474	Oceanography/Geosciences, Multi.

**Table 7. First and second research field according to WoS categories for appointment no. 2 - Social & Political Geography – 10 candidates.**

<i>Candidate no.</i>	First Research Field (2003-2012)		Second Research Field (2003-2012)
	WoS Category	IF aggregate 2012	WoS Category
1	Geography	1.469	Industrial Relations & Labor
2	Geography	1.469	Environmental Sciences
3	Geography	1.469	Economics; Management
4	Geography	1.469	Environmental Studies; Economics
5	Geography	1.469	Economics
6	Geography	1.469	Geography, Physical
7	Geography	1.469	Urban Studies
8	Geography	1.469	Environmental Studies & Sciences
9	Economics	1.148	Geography; Planning & Development
10	Geography	1.469	Economics

*Results obtained in appointment no. 3 (Demography & Population Geography)*

Applicants were invited to create their individual Google Scholar Citations profiles and make them publicly available for a couple of weeks.

From the nine applicants:

- six created a GS Citation Profile

- two refused to create one
- one followed the invitation, but the profile was incomplete

The tool ‘Publish or Perish’, particularly designed for this purpose, was then used for collecting and checking the data.

First of all, two key aspects (Focus 1 and 2) of each candidate’s publications were determined in GS (free keywords) and in Web of Science according to the assigned Subject Categories (WoS categories) in the database. The results are shown in Table 8.

**Table 8. First and second research field in WoS categories and GS for appointment no. 3– 9 candidates.**

<i>Candi date no.</i>	Google Scholar		Web of Science	
	Focus 1	Focus 2	WoS Category 1	WoS Category 2
1	Human Geography -	Area Studies - East Asia - Japan	Urban Studies	Area Studies
2	Human Geography	Population Geography	Geography	Geography
3	Migration Studies	Demographic Change	Geography	Geography, Physical
4	Migration	Urban Studies	Geography; Planning & Development	Urban Studies
5	Urbanization	Cross-border Mobility	Geography	Geography, Physical
6	Demography	Fertility	Demography	Geography
7	Demography	Population	Demography	Public, Environmental & Occupational Health
8	Population Geography	Migration and Labour Markets	Geography	Political Science
9	Resilience	Livelihood	Public, Environmental & Occupational Health	Geography, Physical

Table 9 represents the publication activity for each scientist according to the most relevant publication types. The data are based on the list of publications submitted by the candidates. In order to distinguish individual scientific career lengths, the year of the first publication activity has been included.

The results hint at very heterogeneous and individual publication strategies taking into account publication types. The three next sections contain coverage and citation analyses performed in the three considered data sources. Table 10 shows the percentage of coverage in Google Scholar for each publication type. Monographs (Books) and Edited Books or Issues are very well covered, probably due to the inclusion of Google Books (Kousha & Thelwall, 2009).

The coverage of Journal Articles is also much higher than in WoS or Scopus (see Table 11). Also of interest is the high coverage of Reports (Working Papers). Chapters in Books are not so well covered, but this is probably due to incidental incorrect citations.

**Table 9. Publication spectrum (publication types) for appointment no. 3. (\*no distinction).**

<i>Candidate no.</i>	<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	<i>5</i>	<i>6</i>	<i>7</i>	<i>8</i>	<i>9</i>
<b>Total (excl. Conferences)</b>	<b>58</b>	<b>73</b>	<b>36</b>	<b>121</b>	<b>73</b>	<b>80</b>	<b>75</b>	<b>60</b>	<b>42</b>
<i>Monographs</i>	5	1	4	4	3	3	3	2	1
<i>Book Chapters</i>	13	32	15	48	17	11	11	21	7
<i>Journal Articles</i>	20	20	5	21	17	44	28	27	20
<i>Proceedings Papers*</i>	2	0	2	1	8	0	8	0	0
<i>Reports (Working Papers)</i>	3	0	7	11	7	13	10	3	11
<i>Book Reviews</i>	8	0	2	8	2	0	0	0	0
<i>Edited Books/Journals</i>	5	20	1	11	5	6	3	3	2
<i>Other Publications</i>	1	0	0	17	14	3	12	4	1
<i>Conferences*</i>	64	94	33	94	4	38	109	90	34
<b>1st Year Publication</b>	<b>1998</b>	<b>1994</b>	<b>2000</b>	<b>1993</b>	<b>1999</b>	<b>1992</b>	<b>1999</b>	<b>1989</b>	<b>2000</b>

**Table 10. Coverage (%) in Google Scholar for each publication type (Appointment no. 3) (\*no distinction).**

<i>Candidate no.</i>	<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	<i>5</i>	<i>6</i>	<i>7</i>	<i>8</i>	<i>9</i>
<b>Total (excl. Conferences)</b>	<b>58</b>	<b>73</b>	<b>36</b>	<b>121</b>	<b>73</b>	<b>80</b>	<b>75</b>	<b>60</b>	<b>42</b>
<b>GS Profile</b>	Yes	Incom- plete	Yes	No	No	Yes	Yes	Yes	Yes
<b>Total Pub (excl. Conf)</b>	44.83%	52.05%	44.44%	57.02%	35.62%	72.50%	77.33%	68.33%	97.62%
<i>Monographs</i>	60.00%	100.00%	50.00%	75.00%	100.00%	100.00%	100.00%	100.00%	100.00%
<i>Book Chapters</i>	16.67%	12.50%	40.00%	56.25%	35.29%	45.45%	90.91%	42.86%	100.00%
<i>Journal Articles</i>	85.00%	50.00%	60.00%	71.43%	41.18%	81.82%	82.14%	100.00%	100.00%
<i>Proceedings Papers*</i>			50.00%		25.00%		100.00%		
<i>Reports</i>	66.67%		28.57%	54.55%	28.57%	46.15%	60.00%	33.33%	90.91%
<i>Book Reviews</i>			50.00%	25.00%	100.00%				
<i>Edited Books/Journals</i>	20.00%	70.00%	100.00%	81.82%	80.00%	83.33%	100.00%	66.67%	100.00%
<i>Other Publications</i>				41.18%		33.33%	41.67%		100.00%
<b>1st Year</b>	<b>1998</b>	<b>1994</b>	<b>1998</b>	<b>1995</b>	<b>1999</b>	<b>1992</b>	<b>1999</b>	<b>1995</b>	<b>2002</b>

Table 11 shows the results of the coverage and citation analyses performed in WoS, including the Cited Reference Search, in Scopus and in Google Scholar. The higher coverage scores in WoS over those in Scopus are due to the inclusion of the Cited Reference Search. This enabled citations not only of journal articles and book indexed in WoS to be retrieved, but also of other books, reports and other document types cited by the core journals in WoS.

All sections include the same indicators for each data source: 1) number of indexed publications; 2) percentage of publications covered according to the provided publication list; 3) number of cited documents; 4) total number of citations; 5) number of citations per cited publication; 6) maximum number of citations attracted by a publication; 7) total h-index and 8) i-index (number of publications with more than 10 citations).

The percentage of self-citations was only calculated for GS, where the number of citations was of sufficient significance.

Table 11 confirms that the values of the main citation indicators (number of citations, citations per cited publication and h-index) are different in absolute values in GS, WoS and Scopus, but are comparable in terms of relative values. Spearman correlations performed for these indicators (number of citations, citations per cited publication and h-index) in the three data sources (WoS, Scopus and Google Scholar) were very strong (varying from 0.8 to 0.95). A detailed coverage and citation analysis for the three most cited document types in Google Scholar, Monographs, Book Chapters and Journal Articles (see Table 12) is shown in Table 13.

**Table 11. Coverage and citation analysis in the three data sources for each candidate (Appointment no. 3)**

Candidate no		1	2	3	4	5	6	7	8	9
Google Scholar	GS Profile available	Incomplete		Yes	No	No	Yes	Yes	Yes	Yes
	Total Pub (excl. Conf)	26	38	22	74	26	60	60	55	44
	% covered in GS	44.83%	52.05%	44.44%	57.02%	35.62%	72.50%	77.33%	68.33%	97.62%
	# cited documents	20	15	16	60	14	53	43	33	23
	Total Citations	123	36	106	667	80	1026	699	320	142
	% Self-citations	5.69%	13.89%	15.09%	7.65%	7.50%	14.52%	16.45%	20.94%	21.13%
	Citations/Cited Pub	6.15	2.40	6.63	11.12	5.71	19.36	16.26	9.70	6.17
	Maximum Citations	20	6	49	86	16	144	165	128	14
	h-index	7	3	5	14	5	19	13	9	8
	i-index (more than 10 cit)	5	0	2	21	3	25	18	8	5
WoS + Cited Ref Search	Total Pub (excl. Conf)	13	11	7	31	10	47	35	15	26
	% covered in WoS + CRS	17.24%	8.22%	16.67%	22.31%	9.59%	53.75%	38.67%	13.33%	52.38%
	# cited documents	11	6	6	29	9	44	31	12	24
	Total Citations	30	6	16	86	17	435	102	39	60
	Citations/Cited Pub	2.73	1.00	2.67	2.97	1.89	9.89	3.29	3.25	2.50
	Maximum Citations	9	1	10	16	4	55	21	24	7
	h-index	4	1	2	6	3	12	5	2	4
	i-index (more than 10 cit)	0	0	1	2	0	14	2	1	0
Scopus	Total Pub (excl. Conf)	9	10	2	11	6	30	16	11	10
	% covered in Scopus	15.52%	13.70%	5.56%	9.09%	8.22%	36.25%	21.33%	18.33%	23.81%
	# cited documents	5	5	1	7	2	24	10	8	9
	Total Citations	22	6	2	35	3	384	58	50	27
	Citations/Cited Pub	4.40	1.20	2.00	5.00	1.50	16.00	5.80	6.25	3.00
	Maximum Citations	11	2	2	22	2	57	23	31	8
	h-index	2	1	1	2	1	11	4	4	3
	i-index (more than 10)	1	0	0	1	0	13	2	1	0
<b>1st Year Publication</b>		<b>1998</b>	<b>1994</b>	<b>2000</b>	<b>1993</b>	<b>1999</b>	<b>1992</b>	<b>1999</b>	<b>1989</b>	<b>2000</b>

**Table 12. Summary of the three most cited publication types in Google Scholar (Appointment no. 3).**

Document Type	% Coverage	% Cited	Citations/Cited P	Maximum Citations	% Self-citations
Book Chapters	48.74%	68.77%	6.21	86	23.04%
Journal Articles	74.62%	74.20%	10.06	144	11.22%
Monographs	87.22%	92.59%	21.17	165	9.76%

The results show that not always the same publication types are the most cited for each candidate. There are individual differences. A separate citation analysis of these publication types is then recommended for evaluation purposes.



**Table 13. Detailed Citation analysis in Google Scholar for each candidate and the three most cited publication types (Appointment no. 3). (the three highest values for each document type are highlighted in different colours).**

Candi date no.	Publication Types	Liste # P	Google Scholar										
			Publications					Citations					
			1st year	# Total	# Not list	# Cited	% cited	% Coverage	# Total	Mean	# Max	# Self	% Self
1	Monographs	5	1998	3	0	3	100.00%	60.00%	19	6.33	7	2	10.53%
	Book chapters	13	2001	3	1	3	100.00%	15.38%	44	14.67	19	4	9.09%
	Journal articles	20	1998	17	0	12	70.59%	85.00%	58	4.83	20	1	1.72%
2	Monographs	1	1994	2	1	2	100.00%	100.00%	7	3.50	6		0.00%
	Book chapters	32	1996	4	0	1	25.00%	12.50%	2	2.00	2		0.00%
	Journal articles	20	1998	10	0	9	90.00%	50.00%	21	2.33	4	3	14.29%
3	Monographs	4	2002	2	0	2	100.00%	50.00%	55	27.50	49	2	3.64%
	Book chapters	15	2003	6	0	4	66.67%	40.00%	8	2.00	4	2	25.00%
	Journal articles	5	2009	3	0	2	66.67%	60.00%	10	5.00	6	0	0.00%
4	Monographs	4	1996	3	0	2	66.67%	75.00%	20	10.00	18	0	0.00%
	Book chapters	48	1996	27	0	25	92.59%	56.25%	313	12.52	86	20	6.39%
	Journal articles	21	1996	15	0	14	93.33%	71.43%	151	10.79	48	7	4.64%
5	Monographs	3	1999	3	0	2	66.67%	100.00%	25	12.50	16	4	16.00%
	Book chapters	17	2001	6	0	4	66.67%	35.29%	12	3.00	5	0	0.00%
	Journal articles	17	2000	7	0	4	57.14%	41.18%	25	6.25	12	1	4.00%
6	Monographs	3	1992	3	0	3	100.00%	100.00%	74	24.67	27	8	10.81%
	Book chapters	11	1997	5	0	5	100.00%	45.45%	11	2.20	4	5	45.45%
	Journal articles	44	1996	36	0	34	94.44%	81.82%	892	26.24	144	126	14.13%
7	Monographs	3	2002	3	0	3	100.00%	100.00%	249	83.00	165	10	4.02%
	Book chapters	11	2005	11	1	8	72.73%	90.91%	64	8.00	16	25	39.06%
	Journal articles	28	1999	23	0	17	73.91%	82.14%	278	16.35	66	68	24.46%
8	Monographs	2	2003	2	0	2	100.00%	100.00%	18	9.00	17	0	0.00%
	Book chapters	21	1995	9	0	6	66.67%	42.86%	36	6.00	15	10	27.78%
	Journal articles	27	1999	27	0	18	66.67%	100.00%	227	12.61	83	39	17.18%
9	Monographs	1	2010	1	0	1	100.00%	100.00%	14	14.00	14	6	42.86%
	Book chapters	7	2005	7	0	2	28.57%	100.00%	11	5.50	8	6	54.55%
	Journal articles	20	2005	20	0	11	55.00%	100.00%	68	6.18	13	14	20.59%

## Conclusions and discussion

The main conclusions of this case study for the field geography can be summarized in the following points:

Differences between research fields more related to the natural sciences than to the social sciences are clearly visible. However, the higher productivity (number of publications per year) and citation counts, are relativized when also considering the higher number of co-authors and percentage of self-citations

- General publication strategies, especially these based on the impact factor, are still more evident in the fields related to the natural sciences
- The results hint at very heterogeneous and individual publication strategies considering the selection of adequate publication channels even in the same research fields
- Journal Articles and Book Chapters are the most used publication channels
- Monographs, Journal Articles (including Proceedings Papers) and Book Chapters are the most cited document types
- The coverage, especially books, is much higher in Google Scholar and suggests the recommendation of this data source as complementary one, although this data source is still a black box (no transparency, missing content information, etc.). In this study the accuracy of the citations in GS was very high (~95%). Nevertheless further

measures are needed to reduce the noise of Google Scholar data in order to increase the significance of this alternative data source for evaluative purposes.

- The values of the main citation indicators might differ in absolute values in GS, WoS and Scopus, but are comparable in terms of relative values.
- This fact suggests a “citation iceberg model” (see Figure 1). The citation analysis in WoS or Scopus shows only the ‘visible part’ but this is generally still related to and indicates the ‘invisible part’.
- Therefore, citation analyses for monographs, book chapters and reports (working papers) should be conducted separately and require the inclusion of complementary data sources. Otherwise relevant publications can be easily missed, resulting in wrong interpretations.
- Peers still have to be aware of blind spots in ‘citation analyses’ (e.g. ‘non cited’ document types and publications) with potentially harmful consequences in evaluation exercises



**Figure 1. Citation “iceberg” model.**

Finally, it should be stressed that citations can only be used as a proxy for impact (and not for the quality) of publications produced in the ‘publish or perish’ community (i.e. the scientists who are committed to publishing their results). However, the scientific community is much broader and also comprises teaching academics as well as representatives from government or industry, who rather use than cite scientific output. Furthermore, our society has become progressively informed (‘societal impact’). Unfortunately alternative metrics (like usage metrics and altmetrics) are still in their infancy (Kurtz M.J. & Bollen. J., 2010; Priem, J. et al., 2012; Gorraiz, J. et al., 2014; Hammarfelt, B., 2014) to measure the impact beyond citations and could not yet be applied to the described appointment procedures due to the current lack of available and reliable data.

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