Article

Suborganizations of Institutions in Library and Information Science Journals

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Abstract: In this paper, we analyze Web of Science data records of articles published from 1991 to 2010 in library and information science (LIS) journals. We focus on addresses of these articles' authors and create citation and collaboration networks of departments which we define as the first suborganization of an institution. We present various rankings of departments (e.g., by citations, times cited, PageRank, publications, *etc*.) and highlight the most influential of them. The correlations between the individual departments are also shown. Furthermore, we visualize the most intense citation and collaboration relationships between "LIS" departments (many of which are not genuine LIS departments but merely affiliations of authors publishing in journals covered by the specific Web of Science category) and give examples of two basic research performance distributions across departments of the leading universities in the field.

Keywords: departments; ranking; PageRank; citations; collaborations

1. Introduction and Related Work

Bibliometric studies can roughly be conducted at three levels—individual researchers (micro-level), institutions (meso-level), and countries (macro-level). Of course, these "basic" levels can have their own sublevels (e.g., regions of a country) or they can be grouped into supralevels (such as continents). There have been many bibliometric analyses at various levels, but we can feel that at the meso-level those analyses have mainly concentrated on institutions as such or that they have not really been large-scale, *i.e.*, involving tens or hundreds of thousands of items to analyze. This study tries to bridge

this gap in the field of library and information science (LIS) by analyzing several tens of thousands of bibliographic records at the meso-level and concentrating on the suborganizations of institutions. An institution (or the primary organization) usually has an organizational structure comprising some suborganizations (level 1) that themselves may consist of other suborganizations (level 2). The depth of this hierarchy may vary—some institutions have a relatively flat structure, while other hierarchies may include suborganizations of even higher levels. A typical academic institution (a university) may be divided into faculties, schools, departments, laboratories, and research groups, which are difficult to capture in scientometric studies due to the inconsistent way they are present (or absent) in authors' addresses. As we will show later on, we will call level-1 suborganizations "departments" for the sake of simplicity. The main research questions of this study are the following: (a) Do Web of Science (WoS) data contain enough information to analyze the scientific performance and collaboration of the departments with which authors of journal articles in the LIS research area are affiliated? (hereafter called "LIS" departments); (b) What are the most intense citations and collaborations between "LIS" departments? and (c) Which "LIS" departments are the most highly ranked by various indicators based on publications from 1991–2010? Responses to these questions will be given in the next sections.

Bibliometric analysis of library and information science institutions has a long history in the United Kingdom. For instance, Bradley *et al.* [1] measured the publication patterns of the Department of Information Studies at the University of Sheffield, Holmes and Oppenheim [2] analyzed the citation impact of British LIS departments, and Oppenheim [3] ranked British LIS schools by citation impact. Seng and Willet [4] conducted a citation analysis of a small number of LIS departments in the UK and LIS departments in the UK were investigated by Webber [5]. British LIS departments were also analyzed webometrically—by Thomas and Willet [6] and by Arakaki and Willet [7]. As for other regions of the world, Aina and Mooko [8] analyzed a small set of top African LIS researchers and defined the centers of the African LIS research. Another tiny group of LIS publications was investigated by Herrero-Solana and Ríos-Gómez [9] to identify the most productive Latin American universities and departments. Meho and Spurgin [10] ranked American LIS schools by the visibility of their faculty in various databases and Yazit and Zainab [11] reported on the publication productivity in LIS of some Malaysian institutions. There have been two large-scale studies in which Yan and Sugimoto [12] explored citation patterns of various LIS institutions and He *et al.* [13] explored tens of thousands of LIS publications, but both of them remained at the institutional level. This study is the only large-scale one at the departmental level and the visualization tools used in this article are discussed by Shannon *et al.* [14].

2. Data and Methods

In November 2012 we manually queried the Web of Science web interface to obtain records of all articles published in the period 1991–2010 and indexed in the Social Sciences Citation Index in the research area "Information Science & Library Science" (ISLS). We were interested in the "article" document type only. In this way, we acquired plain text metadata on 46,800 journal articles. (Saving to plain text took about 50 min because a maximum of 500 records can be saved at once by anyone with a Web of Science subscription.) These metadata typically include an article's title, journal name,

volume, issue, pagination, and year as well as its authors' names, addresses, times cited count and some other information. An example of a journal record is presented in Figure 1. As we can see, only some of the cited references (CR) can be identified unambiguously—in this case with a digital object identifier (DOI). The remaining references can be identified using the volume, issue, and pagination or cannot be identified at all. To create a citation network from the article records retrieved (a basic, root, or seed set of articles), we need one more tool.

Figure 1. A sample journal article record.

```
PT J
AU Schreiber, M
AF Schreiber, Michael
TI A new family of old Hirsch index variants
SO JOURNAL OF INFORMETRICS
LA English
DT Article
DE Hirsch index; g-Index; Performance evaluation; Citations; Ranking; Generalized mean
ID SCIENTIFIC-RESEARCH OUTPUT; H-INDEX; EGGHES G; PHYSICISTS
AB The Hirsch index h and the g index proposed by Egghe as well as the f index and the t index.
C1 Tech Univ Chemnitz, Inst Phys, D-09107 Chemnitz, Germany.
RP Schreiber, M (reprint author), Tech Univ Chemnitz, Inst Phys, D-09107 Chemnitz, Germany.
EM schreiber@physik.tu-chemnitz.de
CR Burrell QL, 2009, SCIENTOMETRICS, V79, P79, DOI 10.1007/s11192-009-0405-3
   Egghe L, 2006, SCIENTOMETRICS, V69, P131, DOI 10.1007/s11192-006-0144-7
   Egghe L., 2006, ISSI NEWSLETTER, V2, P8
   Egghe L, 2008, J AM SOC INF SCI TEC, V59, P1304, DOI 10.1002/asi.20823
   Hirsch JE, 2005, P NATL ACAD SCI USA, V102, P16569, DOI 10.1073/pnas.0507655102
   Prathap G, 2006, CURR SCI INDIA, V91, P1439
   Rousseau R., 2006, SIMPLE MODELS CORRES
   Schreiber M, 2007, ANN PHYS-BERLIN, V16, P640, DOI [10.1002/andp.200710252,
10.1002/andp.20071025]
   Schreiber M, 2010, J AM SOC INF SCI TEC, V61, P169, DOI 10.1002/asi.21218
   SCHREIBER M, 2010, ANN PHYS BERLIN
   Schreiber M, 2008, J AM SOC INF SCI TEC, V59, P1513, DOI 10.1002/asi.20856
   Schubert A, 2007, SCIENTOMETRICS, V70, P201, DOI 10.1007/s11192-007-0112-x
   Tol RSJ, 2009, SCIENTOMETRICS, V80, P317, DOI 10.1007/s11192-008-2079-7
   Woeginger GJ, 2009, J AM SOC INF SCI TEC, V60, P1267, DOI 10.1002/asi.21061
NR 14
TC 2
Z9 2
PU ELSEVIER SCIENCE BV
PI AMSTERDAM
PA PO BOX 211, 1000 AE AMSTERDAM, NETHERLANDS
SN 1751-1577
J9 J INFORMETR
JI J. Informetr.
PD OCT
PY 2010
VL 4
IS 4
BP 647
EP 651
DI 10.1016/j.joi.2010.05.002
PG 5
WC Information Science & Library Science
SC Information Science & Library Science
GA 647KA
UT WOS:000281616200020
ER
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Therefore, in the next step, we used the Web Services Lite application programming interface (API) to retrieve the records of articles citing the articles in the basic set. This API is available for free to anyone with a Web of Science subscription after registration. In total, we got 175,139 citing article records. The information contained in the citing article records is somewhat less abundant than in the plain text seed article records. In particular, any author address information is missing. On the other hand, citing article records are structured in a similar way as XML records. See Figure 2 for an example of a citing article record. In the example, an article with ID (UT) 000283981500004 is cited by an article with ID 000283981500001. These IDs can then be matched with "UT WOS" in seed article records (see bottom of Figure 1) and, as a result, a complete citation network of the articles in the root set can be constructed. This citation graph had 94,836 edges, *i.e.*, slightly over 54% of all citations were citations within the seed set.
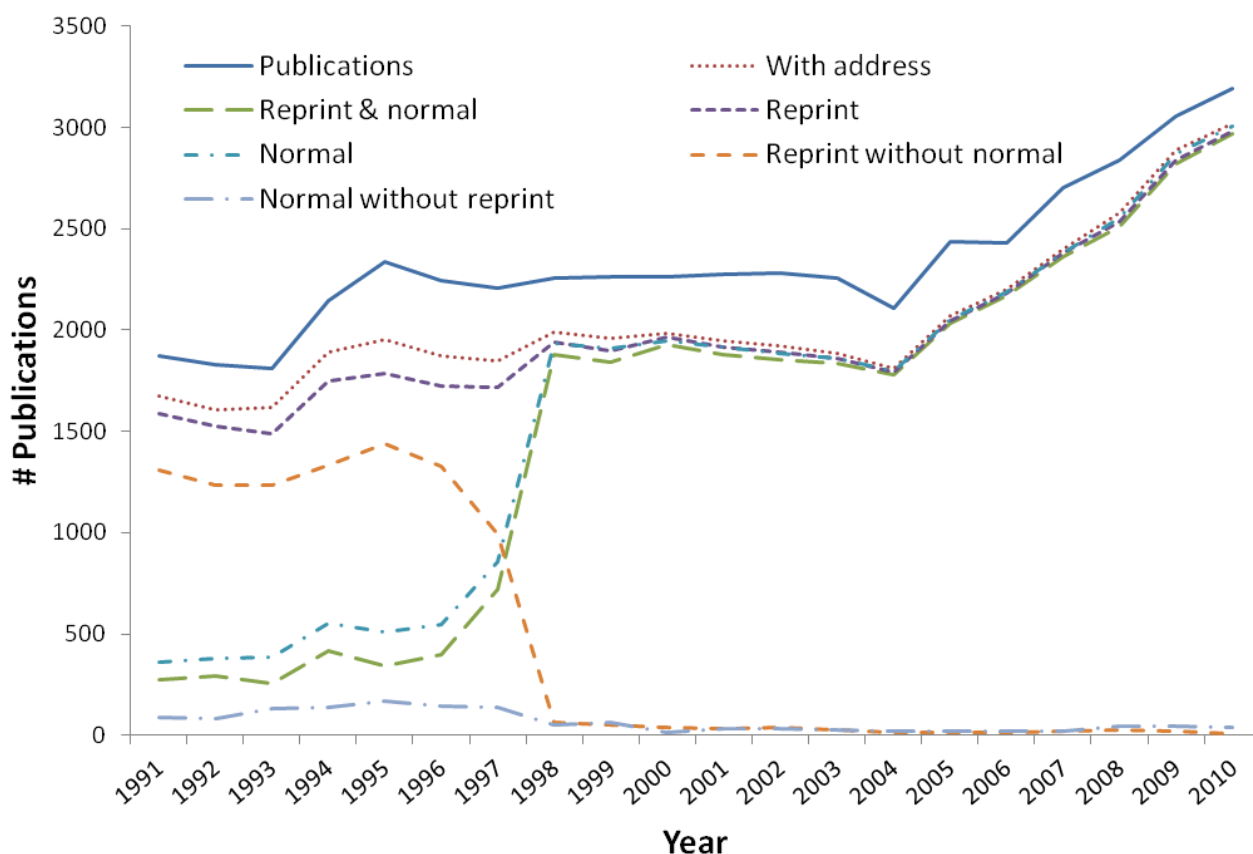
Figure 2. A sample citing article record.

```
<soap:Envelope xmlns:soap="http://schemas.xmlsoap.org/soap/envelope/">
<soap:Body><ns2:citingArticlesResponse xmlns:ns2="http://woksearchlite.cxf.wokmws.thomsonreuters.com">
<return><parent><authors><label>Authors</label><values>Urquhart, C</values><values>Thomas, R</values>
<values>Ovens, J</values><values>Lucking, W</values><values>Villa, J</values></authors>
<source><label>Issue</label><values>4</values></source><source><label>Pages</label><values>277-285
</values></source><source><label>Published.BiblioDate</label><values>DEC</values></source><source>
<label>Published.BiblioYear</label><values>2010</values></source><source><label>SourceTitle</label>
<values>HEALTH INFORMATION AND LIBRARIES JOURNAL</values></source>
<source><label>Volume</label><values>27</values></source><title><label>Title</label>
<values>Planning changes to health library services on the basis of impact assessment</values></title>
<UT>000283981500004</UT></parent><queryID>54</queryID><records><authors><label>Authors</label>
<values>Grant, MJ</values></authors><source><label>Issue</label><values>4</values></source>
<source><label>Pages</label><values>259-261</values></source>
<source><label>Published.BiblioDate</label><values>DEC</values></source><source>
<label>Published.BiblioYear</label><values>2010</values></source><source><label>SourceTitle</label>
<values>HEALTH INFORMATION AND LIBRARIES JOURNAL</values></source>
<source><label>Volume</label><values>27</values></source><title><label>Title</label>
<values>Writing for publication: ensuring you find the right audience for your paper</values></title>
<UT>000283981500001</UT></records><recordsFound>1</recordsFound><recordsSearched>3126432
</recordsSearched></return></ns2:citingArticlesResponse></soap:Body></soap:Envelope>
```

Since this paper is concerned with departments, the research depends on the extent to which affiliations and addresses of article authors are systematically present in the records we analyzed. There is no genuine affiliation information in the records, but there is often information on authors' addresses denoted with C1 and RP like in Figure 1. RP means a "reprint address", which is the address of the corresponding author (usually, but not always, the first author), and C1 is a field containing authors' addresses. Reprint and "normal" addresses may sometimes be the same, for instance when there is one author only. In total, almost 88% of publications had some address information associated with them and 65% had both reprint and normal address. 85% of publications had a reprint address and 68% had one normal address at least, but the latter percentage was quite different in various years under study as can be seen from Figure 3. While the share of publications with some address information has been about 90% throughout the period, the number of publications with one normal address at least has only had a similar share since 1998. Before 1998 there was a high percentage of publications having a reprint but no normal address (from 45% to 70%), but this was almost negligible

in later years and so was the number of articles having a normal address but no reprint address in the whole period 1991–2010.

Figure 3. Numbers of publications with different types of addresses.

As can be seen in Figure 1, addresses have a relatively clear structure starting with an institution followed with suborganizations (from bigger to smaller ones) and ending with a city and a country. Organizations (institutions) and suborganizations are written using standardized abbreviations and are delimited with commas as are cities and countries. In our experience, reprint addresses often include also other information such as street names and numbers or state or province names, *etc*. This additional information can distort the common address pattern "institution, suborganizaiton1, …, suborganizationN, city (+ZIP), country", but based on our experiments with random address samples and a manual checking of the pattern correctness, the pattern is violated in a few percent of cases even if reprint addresses are included. As a result, we made an approximation and considered all addresses in all publications in the period 1991–2010 as having an institution as their first item, a city and a country as their last item, and suborganizations in between. The number of suborganizations can vary as shown in Table 1. In the data under study, an institution (main organization) can have up to seven suborganizations associated with it, but most affiliations consist of an institution and its suborganization. Thus, before all the experiments whose results will be reported in the next section, we retained suborganization 1 in each address and discarded the other suborganizations of higher levels. We will call the couple "institution; suborganization 1" a "department" because this is typically what is represented by that.

Table 1. Examples of various suborganizations of an institution.

Organization	Suborganization 1	Suborganization 2	Suborganization 3
Indiana Univ			
Indiana Univ	Sch Lib & Informat Sci		
Indiana Univ	Sch Business	Decis & Informat Syst Dept	
Indiana Univ	Sch Med	Dept Med	Div Gen Med & Geriatr
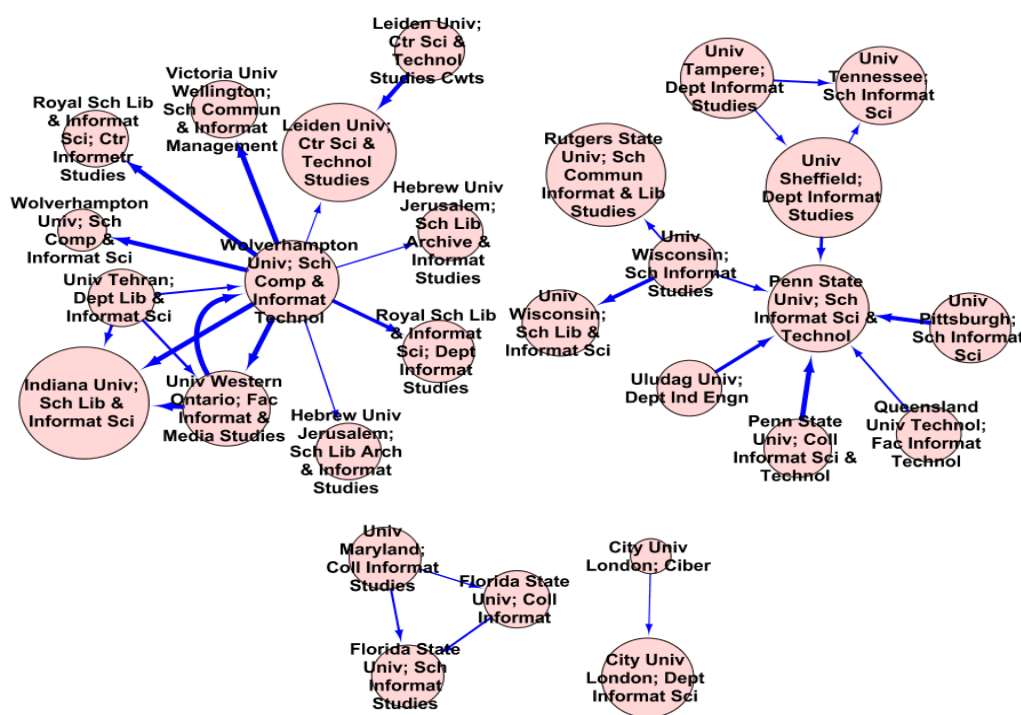
3. Results and Discussion

The citation graph of departments we obtained had 18,291 nodes and 154,744 edges. The graph is directed and the edges are weighted with an average weight of 2.62 per edge. The total sum of edge weights in the graph (404,755) is the total number of citations between departments. In Table 2 we can see the departments that received the most citations: "Indiana Univ; Sch Lib & Informat Sci", "Leiden Univ; Ctr Sci & Technol Studies", and "Univ Sheffield; Dept Informat Studies". However, the numbers of publications by which the departments are represented (see the last column in Table 2) vary significantly so "Leiden Univ; Ctr Sci & Technol Studies" with 3722 citations and 84 publications is actually relatively more cited than "Indiana Univ; Sch Lib & Informat Sci" with 4334 citations and 243 publications (44 citations per publication compared to 18). But the measure of citations per publication is obviously biased towards departments with fewer publications. For instance, the relatively most cited department in Table 2 is "Lib Hungarian Acad Sci; Bibliometr Serv" (position 33) with 165 citations per publication.

As far as the citations between individual departments are concerned, we can see the most intense of them in Figure 4. The size of nodes is based on the "times cited" (see below for an explanation) of a department and the thickness of edges depends on the number of citations from one department to another. We can notice that there are two big components—one centred around "Wolverhampton Univ; Sch Comp & Informat Technol" and the other one around "Penn State Univ; Sch Informat Sci & Technol". The most intense citations as such are those from "Wolverhampton Univ; Sch Comp & Informat Technol" to "Indiana Univ; Sch Lib & Informat Sci", "Victoria Univ Wellington; Sch Commun & Informat Management", and "Univ Western Ontario; Fac Informat & Media Studies". There are also intra-institutional citations such as from "Wolverhampton Univ; Sch Comp & Informat Technol" to "Wolverhampton Univ; Sch Comp & Informat Sci" or from "Penn State Univ; Coll Informat Sci & Technol" to "Penn State Univ; Sch Informat Sci & Technol", but these may sometimes be self-citations of departments that changed their names or whose names are used inconsistently. These errors are inherent in the Web of Science data and they could be removed only by means of a huge amount of manual effort. In total, we found that 4.3% of all citations were intra-institutional.

Table 2. Top 40 "library and information science (LIS)" departments by citations.

|	Department	Citations	Publications
1	Indiana Univ; Sch Lib & Informat Sci	4334	243
2	Leiden Univ; Ctr Sci & Technol Studies	3722	84
3	Univ Sheffield; Dept Informat Studies	3606	195
4	Rutgers State Univ; Sch Commun Informat & Lib Studies	3413	144
5	Penn State Univ; Sch Informat Sci & Technol	3361	56
6	Univ Maryland; Robert H Smith Sch Business	3013	52
7	Univ Minnesota; Carlson Sch Management	2835	71
8	Univ Tennessee; Sch Informat Sci	2661	118
9	Drexel Univ; Coll Informat Sci & Technol	2288	101
10	Univ Tampere; Dept Informat Studies	2285	96
11	City Univ London; Dept Informat Sci	2162	192
12	Univ Western Ontario; Fac Informat & Media Studies	2125	138
13	Wolverhampton Univ; Sch Comp & Informat Technol	2068	109
14	Univ British Columbia; Fac Commerce & Business Adm	1821	26
15	Univ Illinois; Grad Sch Lib & Informat Sci	1710	167
16	Queens Univ; Sch Business	1651	24
17	Univ N Carolina; Sch Lib & Informat Sci	1630	102
18	Harvard Univ; Sch Med	1516	143
19	Univ Georgia; Terry Coll Business	1484	38
20	Florida State Univ; Coll Business	1447	36
21	Univ Virginia; Mcintire Sch Commerce	1413	18
22	Syracuse Univ; Sch Informat Studies	1273	162
23	Georgia State Univ; Coll Business Adm	1266	24
24	Univ Calif Irvine; Grad Sch Management	1261	25
25	Univ Wisconsin; Sch Lib & Informat Sci	1195	71
26	Royal Sch Lib & Informat Sci; Dept Informat Studies	1158	31
27	Univ Pittsburgh; Sch Informat Sci	1150	84
28	Univ So Calif; Marshall Sch Business	1139	28
29	City Univ Hong Kong; Dept Informat Syst	1064	64
30	Univ N Texas; Sch Lib & Informat Sci	1053	60
31	Univ Calif Los Angeles; Grad Sch Educ & Informat Studies	1015	42
32	Univ S Florida; Coll Business Adm	992	17
33	Lib Hungarian Acad Sci; Bibliometr Serv	991	6
34	Katholieke Univ Leuven; Steunpunt O&o Stat	984	20
35	Univ Arkansas; Sam M Walton Coll Business	973	11
36	Florida State Univ; Sch Informat Studies	971	53
37	Csic; Cindoc	966	32
38	Georgia State Univ; Dept Comp Informat Syst	966	27
39	Univ Wisconsin; Sch Lib & Informat Studies	946	74
40	Univ N Carolina; Kenan Flagler Business Sch	926	13

Figure 4. Most intense citations between "LIS" departments.

The citations shown in Table 2 are based on the citation graph of departments, which was generated from the core 46,800 publication records retrieved. Citations from publications outside of this core are not counted in, but they are included in the "Times Cited" indicator which is present in each publication record retrieved (TC in Figure 1). The ranking of departments by times cited looks different than that in Table 2 and the top departments are presented in Table 3. The best three departments are "Univ Minnesota; Carlson Sch Management", "Harvard Univ; Sch Med", and "Univ Maryland; Robert H Smith Sch Business". Again, departments with fewer publications often have higher times cited counts. An extreme case is "Univ So Calif; Knowledge Syst Lab" with one publication only and the largest times cited in Table 3. Note that the times cited count is not always greater than or equal to citations because both indicators are based on different citation graphs—the citation graph of articles and the citation graph of departments, respectively. Imagine a department affiliated with one article only that is merely cited once from an article with which three distinct departments are affiliated. In that case the cited department's times cited count is 1 and its citations indicator is 3. Thus the ranks of individual departments in both rankings can differ significantly. For example, "Univ So Calif; Knowledge Syst Lab" is ranked 10th by times cited but 396th by citations or "Lib Hungarian Acad Sci; Bibliometr Serv" is 33th by citations but 155th by times cited. Anyway, the interpretation may be that "Univ So Calif; Knowledge Syst Lab" is relatively more cited by researchers from other scientific fields than from the community of library and information science whereas "Lib Hungarian Acad Sci; Bibliometr Serv" is relatively more cited from within the community than from outside of it. There is also one highly ranked "department" by times cited, namely "The Scientist; 3600 Market St", which is wrongfully identified as such from frequent addresses associated with "The Scientist" journal articles in WoS data and which is ranked very low by citations. Nevertheless, the correlation between the department rankings by citations and by times cited is still rather high as will be shown later on. By the way, many of the present departments are not genuine LIS departments,
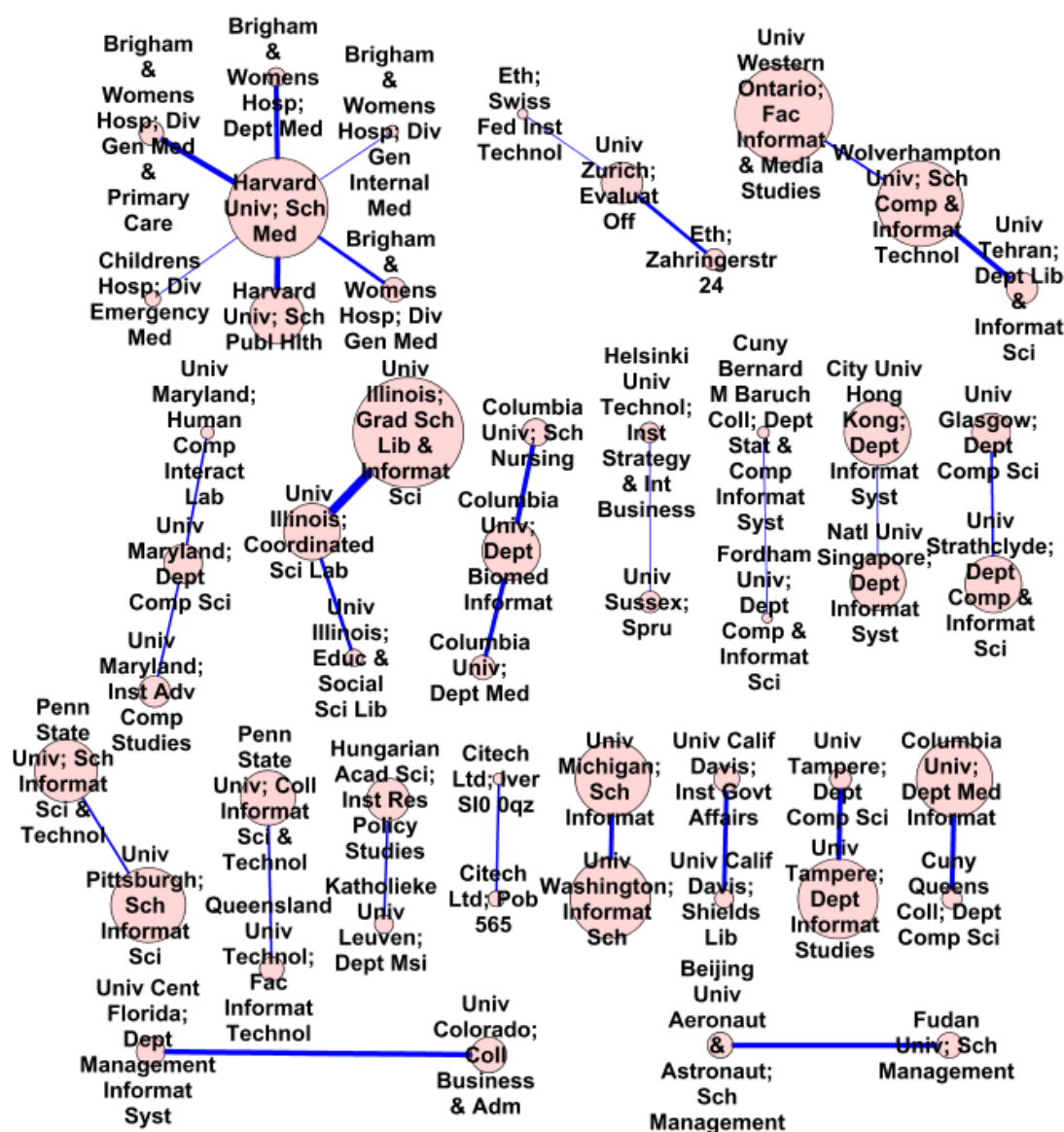
but are affiliations of authors publishing in journals categorized as ISLS by WoS showing the multidisciplinarity of this field. On the other hand, some LIS research is also published in other WoS categories not covered by this study.

Table 3. Top 40 "LIS" departments by times cited.

	Department	Times Cited	Publications
1	Univ Minnesota; Carlson Sch Management	4756	71
2	Harvard Univ; Sch Med	4051	143
3	Univ Maryland; Robert H Smith Sch Business	3860	52
4	Indiana Univ; Sch Lib & Informat Sci	3475	243
5	Queens Univ; Sch Business	3070	24
6	Rutgers State Univ; Sch Commun Informat & Lib Studies	2950	144
7	Univ Virginia; McIntire Sch Commerce	2942	18
8	The Scientist; 3600 Market St	2922	569
9	Univ Sheffield; Dept Informat Studies	2761	195
10	Univ So Calif; Knowledge Syst Lab	2696	1
11	Leiden Univ; Ctr Sci & Technol Studies	2673	84
12	Univ Arkansas; Sam M Walton Coll Business	2169	11
13	Univ British Columbia; Fac Commerce & Business Adm	2167	26
14	Univ Georgia; Terry Coll Business	2022	38
15	Penn State Univ; Sch Informat Sci & Technol	2017	56
16	Florida State Univ; Coll Business	2008	36
17	Georgia State Univ; Coll Business Adm	1967	24
18	Harvard Univ; Sch Publ Hlth	1707	38
19	Univ Illinois; Grad Sch Lib & Informat Sci	1669	167
20	Wolverhampton Univ; Sch Comp & Informat Technol	1669	109
21	Univ Tampere; Dept Informat Studies	1621	96
22	City Univ London; Dept Informat Sci	1580	192
23	Drexel Univ; Coll Informat Sci & Technol	1535	101
24	Univ Tennessee; Sch Informat Sci	1488	118
25	City Univ Hong Kong; Dept Informat Syst	1459	64
26	Univ So Calif; Marshall Sch Business	1446	28
27	Georgia State Univ; Robinson Coll Business	1421	25
28	Univ Calif Irvine; Grad Sch Management	1385	25
29	Univ Western Ontario; Fac Informat & Media Studies	1332	138
30	Univ S Florida; Coll Business Adm	1233	17
31	Univ N Carolina; Sch Lib & Informat Sci	1180	102
32	Syracuse Univ; Sch Informat Studies	1178	162
33	Stanford Univ; Sch Med	1162	76
34	Univ Penn; Wharton Sch	1141	49
35	Georgia State Univ; Dept Comp Informat Syst	1076	27
36	Brigham & Womens Hosp; Div Gen Med & Primary Care	1074	16
37	Univ N Carolina; Kenan Flagler Business Sch	1064	13
38	McGill Univ; Fac Management	1063	20
39	Univ Western Ontario; Sch Business Adm	1056	2
40	Carnegie Mellon Univ; Grad Sch Ind Adm	1046	15

We did not make an attempt to disambiguate and/or unify the names of institutions and suborganizations, but we used them as they were in WoS data. Instead, we tried to estimate the share of possible duplicate departments. The easiest way to do so was to calculate the similarities of all department names in three random samples of 500 departments using a well known algorithm and then manually check the department pairs whose similarity reached a certain threshold. The determined share of duplicate departments was always below 1%. Thus, we believe that the absence of name disambiguation and unification (which is a very time-consuming task) does not significantly affect the results of this study.

Figure 5. Most intense collaborations between "LIS" departments.

Apart from citations, we can also inspect collaboration patterns. The most intense collaborations between departments are depicted in Figure 5, where the node size depends on the publication count of a department and the edge thickness depends on the number of collaborations. The three most intense collaborations occur between "Univ Illinois; Coordinated Sci Lab" and "Univ Illinois; Grad Sch Lib & Informat Sci" (an intra-institutional collaboration), "Brigham & Womens Hosp; Div Gen Med &

Primary Care" and "Harvard Univ; Sch Med", and "Harvard Univ; Sch Med" and "Harvard Univ; Sch Publ Hlth" (also an intra-institutional collaboration). "Harvard Univ; Sch Med" is the "centre" of the biggest community in Figure 5 collaborating with four "Brigham & Womens Hosp" departments, with another "Harvard Univ" department, and with "Childrens Hosp; Div Emergency Med". The share of intra-institutional interactions is substantially greater with collaborations than with citations—we found that almost 22% of all 22,569 collaborations were intra-institutional. As for the strength of the relationship between citations and collaborations, it does not seem meaningful to draw any conclusions from our data since only about 6% of collaborations occurred more than once and only about 1.5% of citations occurred more than ten times.

In addition to the rankings by citations or times cited, we created also other rankings of "LIS" departments based on other indicators: *Publications* (by the number of publications), *Indegree* (like citations but with all weights in the citation graph of departments set to 1), *AvgTimesCited* (average times cited per publication), *HindexByTimesCited* (h-index as defined by Hirsch [15] and based on times cited), *HindexByEdges* (based on citations within the graph), *HITS* [16], *PageRank* [17], and *Weighted PageRank* [18]. From these other eight rankings we only show the top 40 departments by PageRank and weighted PageRank in Table 4 and Spearman's rank correlations between all the rankings in Table 5 (all significant at the 0.01 leveltwo-tailed).

The PageRank and weighted PageRank rankings are the most highly correlated rankings of all with a rank correlation coefficient of 0.996 and also the first difference in the rankings is at rank 5, where there is "Haifa Univ; Dept Geog" by PageRank and "Univ Minnesota; Carlson Sch Management" by the weighted PageRank. Otherwise, the rankings in Table 4 are quite similar to each other but less so to the ranking by citations (correlation about 0.83) and even less to the ranking by times cited (around 0.69). PageRank-like algorithms (and also HITS) are iterative recursive methods dependent on the structure of the citation graph of departments and, therefore, they are much more related to citations than to times cited. Although the top departments shown in Table 4 do not resemble those in Tables 2 and 3, the overall rankings are still quite strongly correlated with all other rankings except *Publications*. The least correlation we found between *Publications* and *AvgTimesCited*—only about 0.2 *Publications* is also the most distant ranking from all others with an average correlation of 0.483.

Finally, to conclude the section on results, in Table 6 we present examples of the most influential departments (by times cited) of four leading universities having the greatest times cited counts in our LIS data set. These universities are "Univ Maryland", "Indiana Univ", "Georgia State Univ", and "Univ Minnesota". We can notice that there are basically two types of performance distribution at institutions—either there is one dominant department like "Carlson Sch Management" at "Univ Minnesota" or "Robert H Smith Sch Business" at "Univ Maryland" or, to a lesser extent, "Sch Lib & Informat Sci" at "Indiana Univ", or there are several comparably well performing departments like "Coll Business Adm", "Robinson Coll Business", and "Dept Comp Informat Syst" at "Georgia State Univ". Even if this example is small, we can assume that all influential institutions whose research influence is investigated at the level of departments can fit into one of these two basic performance distribution schemes.

Table 4. Top 40 "LIS" departments by PageRank and weighted PageRank.

	PageRank	Weighted PageRank
1	Inst Studies Res & Higher Educ; Munthes Gt 29	Inst Studies Res & Higher Educ; Munthes Gt 29
2	Norwegian Radium Hosp; Inst Canc Res	Norwegian Radium Hosp; Inst Canc Res
3	Univ Missouri; Med Informat Grp	Univ Missouri; Med Informat Grp
4	Univ Missouri; Program Hlth Serv Management	Univ Missouri; Program Hlth Serv Management
5	Haifa Univ; Dept Geog	Univ Minnesota; Carlson Sch Management
6	Univ Maryland; Dept Geog	Indiana Univ; Sch Lib & Informat Sci
7	Enea; Cr Casaccia	Haifa Univ; Dept Geog
8	Univ Washington; Coll Educ	Univ Hull; Inst European Publ Law
9	Washington State Univ; Edward R Murrow Sch Commun	Univ Hull; Sch Law
10	Cornell Univ; Coll Agr & Life Sci	Rutgers State Univ; Sch Commun Informat & Lib Studies
11	Cornell Univ; Coll Vet Med	Enea; Cr Casaccia
12	Univ Hull; Sch Law	Univ Maryland; Dept Geog
13	Univ Hull; Inst European Publ Law	Univ Washington; Coll Educ
14	Univ Minnesota; Carlson Sch Management	Univ Sheffield; Dept Informat Studies
15	Enea; Res Ctr Casaccia	Cornell Univ; Coll Vet Med
16	Univ Hamburg; Inst Ethnol	Queens Univ; Sch Business
17	Univ Calabria; Ctr Ingn Econ & Sociale	Leiden Univ; Ctr Sci & Technol Studies
18	Enea; Ente Nuove Tecnol Energia Ambiente	Cornell Univ; Coll Agr & Life Sci
19	Indiana Univ; Sch Lib & Informat Sci	Washington State Univ; Edward R Murrow Sch Commun
20	Rutgers State Univ; Sch Commun Informat & Lib Studies	Univ British Columbia; Fac Commerce & Business Adm
21	Queens Univ; Sch Business	Penn State Univ; Sch Informat Sci & Technol
22	Univ Vermont; Sch Business Adm	Univ Illinois; Grad Sch Lib & Informat Sci
23	Univ Sheffield; Dept Informat Studies	Univ Maryland; Robert H Smith Sch Business
24	Univ Virginia; Mcintire Sch Commerce	Harvard Univ; Sch Med
25	Leiden Univ; Ctr Sci & Technol Studies	Enea; Res Ctr Casaccia
26	Univ Maryland; Hlth Sci Lib	Univ Tennessee; Sch Informat Sci
27	Univ Illinois; Grad Sch Lib & Informat Sci	Univ Vermont; Sch Business Adm
28	Univ Michigan; Alfred Taubman Med Lib	Univ Virginia; Mcintire Sch Commerce
29	Univ Texas; Grad Sch Business	Univ Penn; Wharton Sch
30	Harvard Univ; Sch Med	Univ Tampere; Dept Informat Studies
31	Natl & Univ Lib Iceland; Interlib Loans Document Delivery Dept	Univ Calif Irvine; Grad Sch Management
32	Reykjavik Univ; European Documentat Ctr	Univ Maryland; Hlth Sci Lib
33	Georgia State Univ; Coll Business Adm	Georgia State Univ; Coll Business Adm
34	Univ Western Ontario; Sch Business Adm	Univ Georgia; Terry Coll Business
35	Univ Calif Irvine; Grad Sch Management	Carnegie Mellon Univ; Grad Sch Ind Adm
36	Univ British Columbia; Fac Commerce & Business Adm	City Univ London; Dept Informat Sci
37	Syracuse Univ; Sch Informat Studies	Univ Michigan; Alfred Taubman Med Lib
38	Univ Michigan; Head Hlth Sci Lib	Univ N Carolina; Sch Lib & Informat Sci
39	Oregon State Univ; Dept Journalism	Drexel Univ; Coll Informat Sci & Technol
40	Carnegie Mellon Univ; Grad Sch Ind Adm	Syracuse Univ; Sch Informat Studies

Table 5. Spearman's rank correlation coefficients between various rankings.

	Avg Times Cited	Citations	Indegree	Publications	Times Cited	Hindex By Edges	Hindex ByTims Cited	HITS	PR	PR weighted
Avg TimesCited	1	0.7009	0.7055	**0.2045**	0.9513	0.6944	0.7048	0.6785	0.6358	0.6340
Citations	0.7009	1	**0.9908**	0.4360	0.7641	0.7805	0.6355	0.9604	0.8300	0.8342
Indegree	0.7055	**0.9908**	1	0.4270	0.7653	0.7790	0.6312	0.9623	0.8416	0.8385
Publications	**0.2045**	0.4360	0.4270	1	0.4561	0.4974	0.6126	0.4052	0.3917	0.3981
TimesCited	0.9513	0.7641	0.7653	0.4561	1	0.7765	0.8224	0.7352	0.6918	0.6923
Hindex ByEdges	0.6944	0.7805	0.7790	0.4974	0.7765	1	0.7879	0.7648	0.6881	0.6887
Hindex ByTimesCited	0.7048	0.6355	0.6312	0.6126	0.8224	0.7879	1	0.6153	0.5978	0.6011
HITS	0.6785	0.9604	0.9623	0.4052	0.7352	0.7648	0.6153	1	0.8020	0.7999
PR	0.6358	0.8300	0.8416	0.3917	0.6918	0.6881	0.5978	0.8020	1	**0.9958**
PR weighted	0.6340	0.8342	0.8385	0.3981	0.6923	0.6887	0.6011	0.7999	**0.9958**	1

Table 6. Top 20 "LIS" departments of four leading universities by times cited.

Univ Maryland		Indiana Univ	
Robert H Smith Sch Business	3860	Sch Lib & Informat Sci	3475
Rh Smith Sch Business	755	Kelley Sch Business	1035
Coll Lib & Informat Serv	597	Sch Med	709
Coll Informat Studies	565	Sch Business	254
Asian Div	480	Dept Telecommun	227
Coll Business & Management	407	Slis	221
Dept Decis & Informat Technol	387	Grad Sch Business	213
Dept Comp Sci	221	Ctr Social Informat	142
Coll Lib & Informat Sci	151	Sch Publ & Environm Affairs	141
Inst Adv Comp Studies	145	Kelly Sch Business	121
Dept Informat Syst	136	Sch Informat	89
Dept Geog	123	Sch Educ	70
Sch Med	100	Regenstrief Inst Hlth Care	62
Human Comp Interact Lab	96	Sch Journalism	51
Amer Use Time Project	72	Dept Geog	44
Joint Program Survey Methodol	69	Inst Commun Res	38
Ctr Comp Sci	65	Dept Instruct Syst Technol	35
College Pk	62	Dept Polit Sci	26
Rh Smith Sch	62	Dept Amer Studies	24
Hlth Sci Lib	58	Roudebush Va Med Ctr	21

Table 6. *Cont.*

Georgia State Univ		Univ Minnesota	
Coll Business Adm	1967	Carlson Sch Management	4756
Robinson Coll Business	1421	Curtis L Carlson Sch Management	609
Dept Comp Informat Syst	1076	Dept Informat & Decis Sci	100
J Mack Robinson Coll Business	697	Sch Journalism & Mass Commun	91
Comp Informat Syst Dept	675	Mis Res Ctr	66
Robinbson Coll Business	220	Dept Geog	46
Dept Management	210	Sch Law	40
Ctr Proc Innovat & Comp Informat Syst	194	Digital Technol Ctr	38
Ctr Proc Innovat	119	Informat & Decis Sci Dept	35
Coll Business	77	Biomed Lib	32
J Mack Robinson Coll Business Adm	45	Dept Psychol	30
Cis Dept	40	E Asian Lib	24
Business Adm	36	Coll Educ & Human Dev	23
Dept Comp Informat Ssyt	36	St Paul Campus Lib	18
Dept Commun	34	Dept Comp Sci & Engn	17
Policy Res Ctr	24	Sch Med	17
Coll Educ	12	Sch Nursing	14
Pullen Lib	11	1445 Gortner Ave	13
William Russell Pullen Lib	11	Sci & Engn Lib	13
Dept Sociol	8	Walter Lib 108	13

4. Conclusions and Future Work

Most large-scale scientometric research at the meso-level is concerned with primary research organizations (institutions), but only few studies analyze the scientific impact and collaboration of the suborganizations of these institutions. These suborganizations can be called schools, departments, divisions, laboratories, *etc.* and they themselves may be divided into further suborganizations of lower levels in the organizational hierarchy of an institution. Varying organizational structures along with ambiguities in the names of suborganizations may be the reason of the lack of large-scale scientometric analyses at the level of departments. This article tries to bridge this gap in the field of library and information science. The main contributions of this study are the following:

- We analyzed the bibliographic records of 46,800 journal articles indexed in the Web of Science category "Information Science & Library Science" that were published between 1991 and 2010.
- We created citation and collaboration networks of level-1 suborganizations that we call departments and we visualized the most intense citations and collaborations between departments.
- We produced various rankings of "LIS" departments using ten well-known methods and computed the correlations between these rankings.

The main findings of our study confirm the sufficiency of WoS data and are as follows:

- Almost 88% of publications had some address information associated with them, but prior to 1998 only few publications had other than reprint addresses included.

- "Indiana Univ; Sch Lib & Informat Sci" is the best department in terms of citations and "Univ Minnesota; Carlson Sch Management" is ranked first by times cited.
- Most cited of all departments is "Indiana Univ; Sch Lib & Informat Sci" by "Wolverhampton Univ; Sch Comp & Informat Technol" and the most intense departmental collaboration occurs between "Univ Illinois; Coordinated Sci Lab" and "Univ Illinois; Grad Sch Lib & Informat Sci".

In our future work on the scientific performance and collaboration at the level of departments, we would like focus on other fields of science, other publication sources (e.g., conference proceedings), and other time periods.

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Conflicts of Interest

The author declares no conflict of interest.

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