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Publishing Trends in Library and Information Sciences Across European Countries and Institutions

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ABSTRACT

Ten bibliometric indicators were used to assess European publishing intensity in journals listed in Scopus under the subject category "Library and Information Science" between 2003 and 2012. The findings were analyzed for the 20 countries and 25 research institutions with the greatest output in that period. The indicators calculated included normalized impact, number and proportion of highly cited papers and the distribution of papers by the quartiles defined in the Scimago Journal Rank (SJR). SJR is a measure of the scientific influence of scholarly journals that accounts for both the number of citations received by a journal and the importance or prestige of the journals where such citations come from. With SJR, the subject field, quality and reputation of the journal have a direct effect on the value of a citation. The analysis covered 11,931 Western and 939 Eastern European papers published in 149 journals. The highest output growth rates were found for Spain, Poland, Portugal, Italy, Greece and Austria. The highest impact ratings were attained by European institutions whose members are prolific authors of papers on informetrics. On the whole, the articles were written primarily in English, Spanish, German or French, while the publications most widely cited appeared in English language journals. This study presents bibliometric data that shed light on the status of Library and Information Science research in Europe today, in the framework of the European Higher Education Area.

INTRODUCTION

The association between university libraries and bibliometric activities can be traced back to the nineteen sixties, when the discipline began to be used to create, manage and assess journal collections (Line, 1978). Interest in learning and using bibliometric techniques has recently rallied with the growing concern around the provision of support services for research.

Universities, research institutions, professors and researchers are immersed in increasingly dense accountability processes and performance assessments due to the pressure exerted by policy makers eager to improve decision-making and reorient and enhance public management of academic science and research (Herther, 2009; MacColl, 2010). Bibliometric indicators can help professors and researchers objectively ascertain the effect and impact of their research and furnish that information in performance assessment processes. That has generated a demand for and an interest in the bibliometric studies conducted primarily by university libraries, the institutions most familiar with the use of citation databases (Corrall, Kennan, & Afzal, 2013). The changes detected in researchers' academic environment also induce libraries to create content addressing information per se rather than only the use of information. Bibliometric-based measurement of professors' impact has thus been added to their research support services. Research impact may be understood to mean any recorded and verifiable effect of the research conducted by one author or group of authors on other actors or organizations (Wouters, 1999).

Ball and Tunger (2006) suggested that bibliometrics opens up a new business area for university libraries, contending that libraries are the sole interdisciplinary and independent institutions able to centralize these services. Drummond and Wartho (2009) described the organizational change undertaken in the University of New South Wales library in the wake of the Australian Government's implementation of a research assessment program entitled Research Quality Framework (Haddow, 2007). The result was the creation of the Research Impact Measurement Service, in which bibliometric indicators are used to measure the impact of faculties' and academics' research. Recent literature contains descriptions of similar services in libraries affiliated with the universities of Buffalo, U.S. (Hendrix, 2010), Vienna, Austria (Gumpenberger, Wieland, & Gorraiz, 2012), Queensland, Australia (Thomas, 2013) and Granada, Spain (Torres-Salinas & Jiménez-Contreras, 2012). Academic librarians providing research support services must, then, understand metrics, data sources and rankings and the respective background to be able to furnish their institutions' researchers with suitable advice (Pagell, 2014).

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The creation and propagation of global university rankings have aroused a good deal of interest of late, inasmuch as they have affected higher education institutions, primarily in the context of an increasingly competitive global market for higher education, with the intensification of transnational assessments of university status, reputation, quality and performance (Hazelkorn, 2013). Rankings set comparable objects on an ordinal scale based on measurements or scores associated with the objects to be compared. A number of authors have reviewed the major university rankings (e.g. Rauhvargers, 2011; Chen & Liao, 2012). One specific type of selective and global university ranking, focusing exclusively on research effort or results, deploys bibliometric indicators and draws from large databases such as Web of Science (WoS) or Scopus to analyze research published and cited. Examples can be found in the Leyden (www.leidenranking.com) and Scimago Institutions (SIR) rankings (www.scimagoir.com).

The present study was conducted along those lines, applying bibliometric indicators to articles published in journals listed in the Scopus Library and Information Science category to compare performance in the major European countries and research institutions from 2003 to 2012. The Scopus database of abstracts and citations of peer-reviewed academic literature was chosen to build the bibliometric indicators used here. Its large size, measured in the number of LIS journals listed (190 titles in 2012), ensures extensive coverage of national and western European academic output, papers in languages other than English and articles authored in eastern Europe (Hoogendoorn, 2008).

The research focused essentially on the acceptance of the number of citations received by a paper as a valid indicator of scientific community use and acknowledgement of its findings. Indeed, bibliometric indicators are the standard measure used at different levels of aggregation and across subject areas and geographies in the routine quantification and assessment of research results and their impact (Garfield, Malin, & Small, 1978; Narin, 1976; van Raan, 1996; Wouters, 1999; Borgman & Furner, 2002; Moed, 2005). For a number of reasons, such analyses have always been controversial (MacRoberts & MacRoberts, 1986, 1989, 1996; Adler, Ewing, & Taylor, 2009). Firstly, the exact reasons for citing a given paper are unknown (Nicolaisen, 2007). Secondly, citation practice and frequency often vary among research communities depending on their communication mores, number of publications reviewed, accessibility of the literature to researchers, languages covered and number of researchers making contributions in the fields considered. Reading habits consequently differ across disciplines and institutions and such variations are difficult to calibrate (Bornmann & Daniel, 2008). Thirdly, incomplete coverage by the databases chosen for analysis may lead to fundamental errors or bias due to the exclusion of technical reports, professional articles or books, which are not indexed. All this affects the accuracy of certain analyses (Meho & Yang, 2007), a problem compounded by the variations in institution and author names included in databases (Jacso, 2009), which may induce erroneous attribution (van Raan, 2004). Due to technical and methodological limitations, then, bibliometric analyses must be established, applied and interpreted cautiously, and always in keeping with best practice (Hicks, Wouters, Waltman, Rijcke, & Rafols, 2015).

BACKGROUND AND PROBLEM POSED

In the United States, rankings in general first began to be used to compare researcher and student performance more or less at the same time as bibliometric studies were introduced, in the early twentieth century (Cattel, 1906; Godin, 2006). Such assessments were conducted with growing intensity throughout that century by official bodies (Stuart, 1995). Bibliometric rankings are a specific instance of that approach. One of the most common ways to present indicator values is by listing countries, institutions or individual authors in descending order (May, 1997; Adam, 1998; King, 2004). Such rankings estimate and compare the competitiveness of research further to a specific portfolio of indicators that establish standards of achievement or results.

A sizeable number of studies have determined LIS output and researcher and journal productivity in the U.S. by counting the number of publications and citations listed in Social Science Citation Index (SSCI) bibliographic records (e.g. Hayes, 1983; Budd & Seavey, 1996; Budd, 2000; Adkins & Budd, 2006; Blessinger & Frasier, 2007). Based on the mere quantification of citations and a single indicator (number of papers/number of citations), such rankings establish a hierarchical list of universities and curricula on the grounds of the scientific impact of their publications, an exercise that has often proved controversial. Some authors contend, for instance, that the number of LIS papers and citations should not be taken from a single database such as *Web of Science* and advocate the use of others for measuring individual researcher or country outputs (Meho & Spurgin, 2005; Meho & Sugimoto, 2009). Since the introduction of the h-index (Hirsch, 2005; Alonso, Cabrerizo, Herrera-Viedma, & Herrera, 2009), studies have been conducted that rank researchers further to that indicator (Cronin & Meho, 2006).

LIS has not been unaffected by the research growth in nearly all countries, including developing countries (Wagner, 2008), in the wake of the creation of national scientific communities (Schott, 1993). In that respect, research has become a planet-wide endeavour, fathering bibliometric studies that characterize the national dimensions of LIS research. Examples can be readily found: Taiwan (Huang & Lin, 2011; Cathy Lin, 2012), China (Wang, 2011; Ma, 2012; Xiao, Zhang, & Li, 2015), Korea (Yang & Lee, 2012), Malaysia (Yazit & Zainab, 2007), Iran (Horri, 2004), Canada (Wolfram, 2012), Australia (Wilson, Boëll, Kennan, & Willard, 2011), Poland (Sapa, 2007) and Spain (Jiménez-Contreras, Delgado López-Cózar, & Ruiz Pérez, 2006; Grupo Scimago, 2006).

Other studies have a multi-national scope, comparing several nations in a given region. Based on an analysis of articles published in 21 core journals indexed in the Social Science Citations Index (SSCI) in 1980–1999, Uzun (2002) quantified the output of 19 Eastern European and developing countries. The largest contributions were made by India in 1980–84, Nigeria in 1985–1994 and China in 1995–1999. On the grounds of the activity index calculated (Frame, 1977), this author found that from 1980 to 1999 LIS research was most intense in Nigeria, Saudi Arabia, Botswana and Kuwait, and the least intense in Brazil, Taiwan, Mexico and India. Park (2008) studied 1397 papers published in 1967–2005 in 20 top LIS journals to ascertain the authorship patterns in the Asia and Pacific region, defined to include Australia, China, South Korea, Taiwan, Singapore, Japan, New Zealand, Malaysia, Thailand and Philippines. The findings revealed that authorship and collaboration differed in library science and information science journals. Australia, New Zealand, Taiwan and South Korea were the most productive countries in the former and Australia, China, South Korea, Singapore and Taiwan the most productive in the latter. A comparative analysis of Latin American output from 1966 to 2003 on a sample of 324 records listed in the Social Science Citation Index (Herrero-Solana & Ríos-Gómez, 2006) analyzed output by country. Brazil, Mexico and Chile were found to have the most prominent output, and individual authorship was observed to prevail. The U.S. was the most frequent collaborator, the National Autonomous University of Mexico the most productive institution and the journals *Scientometrics* and *Journal of the American Medical Informatics Association* the primary communication vehicles.

This study aimed to identify the European countries, universities and research institutions engaging most intensely in LIS, using bibliometric indicators to characterize their scientific output. To that end, the following mix of indicators was deployed: basic indicators available for decades, relative or normalized indicators that correct certain biases and advanced network analysis indicators that denote ‘influence’ or ‘prestige’. The findings should help anyone engaging in the profession to understand the status of Library and Information Science research in Europe today, in the framework of the European Higher Education Area.

The questions posed and explored in the article are as follows.

Q1: Based on output, how intensely has LIS research been published by European countries and research institutions?
Q2: How do countries and institutions rank in citation-based impact listings? How do European universities compare with other public research institutes in Europe in terms of impact?
Q3: Which LIS journals are the core vehicles for authors residing in the European Union?

The replies to these questions ultimately corroborated the starting hypothesis, according to which peripheral universities and research institutions that do not form part of the European elite are nonetheless raising their visibility and impact, enabling them to acquire a position closer to their more central, elite European counterparts.

The article is organized as follows. The data sources, methodology and indicators calculated are described in Data and methods, which are followed by a section on the findings and another where they are discussed. The conclusions are listed at the end of the paper, in keeping with standard practice.

DATA AND METHODS

The empirical material used in this study consisted of the original data in the Scopus multi-disciplinary index compiled for the SCImago Institutions Rankings (SIR) database. Scopus, published by Elsevier, is the most comprehensive abstract and citations database of peer-reviewed academic journals. It contains over 20,800 periodicals issued by 5000 publishers the world over and lists academic and professional journals, newsletters, book series, and articles published in the proceedings of the major scientific conferences. Publications from every region in the world are listed, along with a wide selection of non-English language journals. In July 2014 the base held approximately 54 million items (Elsevier, 2014) and its data on scientific papers and citations have remained stable and comparable since its launch in 2004 (Archambault, Campbell, Gingras, & Lariviere, 2009).

The SIR lists bibliometric indicators for 4112 universities and research institutes the world over (November 2014) that have published at least 100 papers during 2012, the last year covered in this study. Meticulous manual and automatic disambiguation of the affiliation names in the Scopus records from 2003 to 2012 identified authors of LIS papers from the following 25 Western and 21 Eastern European countries:

Western Europe		Eastern Europe	
Austria*	AUT	Armenia	ARM
Belgium*	BEL	Azerbaijan	AZE
Cyprus*	CYP	Belarus	BLR
Denmark*	DNK	Bosnia and Herzegovina	BIH
Finland*	FIN	Bulgaria*	BGR
France*	FRA	Croatia*	HRV
Germany*	DEU	Czech Republic*	CZE
Greece*	GRC	Estonia*	EST
Iceland	ISL	Georgia	GEO
Ireland*	IRL	Hungary*	HUN
Italy*	ITA	Latvia*	LVA
Liechtenstein	LIE	Lithuania*	LTU
Luxembourg*	LUX	Macedonia	MKD
Netherlands*	NLD	Montenegro	MNE
Norway	NOR	Poland*	POL
Portugal*	PRT	Romania*	ROU
Spain*	ESP	Russian Federation	RUS
Sweden*	SWE	Serbia	SRB
Switzerland*	CHE	Slovakia*	SVK
United Kingdom*	GBR	Slovenia*	SVN
San Marino	SMR	Ukraine	UKR
Iceland	ISL		
Cyprus*	CYP		
Malta*	MLT		
Monaco	MCO		
* European Union	EU-28		

The present study covered the data for the 20 most productive countries in the period. The institutions chosen for analysis had to be independent bodies such as universities and public research institutes publishing fairly intensely. Hence, European institutions that published fewer than 85 papers in 2003–2012 were excluded.

Further to Moed and Plume's (2011) classification, the indicators calculated in the SJR constitute "first generation" information (i.e., number of publications and citations, citations per paper…), as well as "second generation" data, for they take into consideration citation practices characterizing different scientific fields (e.g., relative normalized impact). They also cover "third generation" items such as the Scimago Journal Rank indicator (www.scimagojr.com), in which a vector space model of journals' co-citation profiles is used to denote journal prestige and identify subject-based inter-journal relationships. Indicator values are determined on the grounds of the prestige of the citing journal and inter-paper co-citation profiles. Consequently, the closer the subject matter between two publications, the greater is their prestige transfer (Guerrero-Bote & Moya-Anegón, 2012). The scientific journals officially included in Scopus by Elsevier are classed by quartiles using this indicator (Colledge et al., 2010).

The SIR subject classification, which concurs with Scopus criteria, lists journals under 27 main areas and 313 more restrictive subject categories, one of which is LIS. The data used to generate the indicators used and given below were drawn from the papers published in the journals listed under that category in 2012.

1. No. of papers or output: number of all manner of publications (articles, reviews, congress communications, editorials, errata, letters, notes and short surveys) with at least one author affiliated with a European country or research institution based on the addresses recorded in Scopus. In all, 11,931 Western and 939 Eastern European papers were identified. This was the main indicator of publishing intensity in the subject area. A number of approaches are in place to count co-authored papers (Gauffriau, Larsen, Maye, Roulin-Perriard, & von Ins, 2007). The present study deployed two. The first and default procedure was the whole counting method (Pw), in which a paper involving international or inter-institutional collaboration (at least two countries or institutions listed in the affiliation) was attributed once to each country or institution with a value of 1. In the second method, the straight counting approach (Ps), the corresponding author, or more precisely, the institution or country with which the corresponding author was affiliated, received full credit for the paper and the others none. In this paper both models for counting output were chosen for the following reasons. Counting publications and citations is essential to scientific productivity and impact assessment studies. Countries' or institutions' positions on a table showing output values or impact as measured by citations are affected by the way in which publications with more than one author are counted (Gauffriau, Larsen, Maye, Roulin-Perriard, & von Ins, 2008). Some procedures for attributing authorship inevitably yield larger numbers than others for a given country or institution. The whole counting method (Pw), for instance, inflates authors' output because it attributes full credit to each and every collaborating country or institution (Huang, Lin, & Chen, 2011). Moreover, in studies involving international collaboration, as this procedure attributes the same value to each authoring country or institution, some countries or institutions may benefit from a higher impact simply by partnering with countries or institutions whose impact indices are higher than average (Guerrero-Bote, Olmeda-Gómez, & Moya-Anegón, 2013). This is often the case in peripheral countries attempting to raise the visibility of their research in the international community by co-publishing with more renowned authors. Consequently, a second method, straight counting (Ps), was also deployed, in which full credit is attributed to the corresponding author (Ps). This technique obviates the inflationary effect of the two aforementioned factors when computing national

and institutional output. The implications of using one method or the other are that the output and impact values found with Pw are generally larger than obtained with Ps. The latter, however, afford a more accurate view of the true scientific capacity of the countries and institutions at issue, particularly in terms of qualitative parameters such as impact (Moya-Anegón, Guerrero-Bote, Bornmann, & Moed, 2013).

2. Percent of international collaboration: percentage of papers with more than one country in the affiliations. This is a size-independent indicator.
3. Compound annual growth rate (CAGR): compound yearly growth rate, used to calculate rises/declines in indicator value over specific time periods. The formula used here was: CAGR = [(initial value / final value)$^{1/n}$ − 1] ∗ 100, where n is the number of years in the period.
4. Scientific pool (Sp): total number of publishing authors affiliated with a given institution or country in a specific period of time. This is a size-dependent indicator.
5. Citations: aggregate number received in 2003–2012 and listed in the Scopus database. All manner of publications were taken into consideration. This size-dependent indicator is a proxy for the impact of the research published by a country or institution as a whole.
6. Percent of papers cited: percentage of papers cited over the total output. It is a size-independent indicator that estimates a country's or institution's aggregate visibility in the period studied.
7. Citations per paper: mean number of citations received by a country's or institution's total output during a given period. It indicates the country's or institution's mean scientific impact in the period studied. The normalized values of this indicator are obtained from the following expression: $V_i = a_i / \max a_i$
8. Normalized citation impact (NI): number of citations received by papers published by a given unit relative to the mean world citations for the same type of papers, time since publication and subject area. The values are normalized at the article level and compare the citations to the worldwide average. An NI value of 0.9, for instance, means that the country's or institution's output is cited 10% less than the world average, whereas a value of 1.2 means that it is cited 20% more than the average (Rehn & Kronman, 2008). This size-independent indicator is calculated on the grounds of articles, reviews and conference communications only.
9. Best paper rate, highly cited papers or excellent papers (Pw_Top 10%; % Pw_Top 10%): absolute or relative (%) measure of the proportion of a country's or institution's publications in the top 10% by number of citations. A paper was regarded to be in the top 10% when it was cited more frequently than 90% of the same type of publications on the same subject area published in the same year (Bornmann & Moya-Anegón, 2014). It is a size-independent measure of a country's or institution's performance (Adams, Gurney, & Marshall, 2007; Bornmann, Moya-Anegón, & Leydesdorff, 2012). Pw_Top 10% refers to the 10% of excellent papers when the output was calculated using the whole counting method (Pw). Ps_Top_10% and %Ps_Top_10% refer to the absolute number or percentage of highly cited papers relative to the total papers counted using the straight counting approach described above (Ps), i.e., in which the respective country or institution was shown in the corresponding researcher's affiliation.
10. Best journal rate (% Q1): the percentage of papers published by an institution in the world's most influential academic journals, i.e., the journals in the first quartile of their respective subject sets, as ranked by the Scimago Journal Rank (SJR). SJR is a variant of the eigenvector centrality measure used in network theory. Such measures establish the importance of a node in a network based on the principle that connections to high-scoring nodes contribute more to the score of the node. The SJR indicator, which is inspired by the PageRank algorithm, was developed for extremely large and heterogeneous journal citation networks. It is a size-independent indicator and it ranks journals by their 'average prestige per article' and can be used for journal comparisons in science evaluation processes. Consequently, "best journal rate (% Q1)" is a size-independent indicator that provides information on the long-term success of an institution's papers or its capacity to publish its research findings in prestigious journals.

RESULTS

PUBLISHING INTENSITY

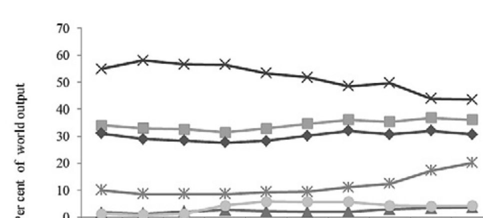
Chart 1 gives the percentage of library and information science papers published by region relative to world output, using the whole counting method (Pw), whereby papers are attributed to all the countries and hence all the regions specified in the affiliation. Papers may therefore be counted twice, thrice or more in some cases, depending on the number of author countries. While Northern America (USA and Canada) and Europe headed the regions by volume, their relative weight declined across the period due to the steeper rise in national output in less developed countries. The compound annual growth rate in the period came to 17% in Asia (primarily as a result of the growth in output in the papers produced in the People's Republic of China, which in 2012 accounted for 48.2% of all Asian scientific publications), 23.3% in Latin America and 17.4% in Eastern Europe. The growth rate in Western Europe (9.1%) was around the same as the worldwide mean (9.1%) while the smallest increase in output was recorded for the USA and Canada, at 6.6%.

The twenty highest ranking European countries in this category with at least 100 papers published in 2003–2012 jointly accounted for 96.7% of Western and Eastern European output.

The fluctuations in national outputs for this subset, analyzed in this section, are given in Table 1, where countries are listed in descending order of total output for the period.

Output was concentrated, with significant differences observed among European countries. The papers authored by scientists from the top five countries accounted for 65% of total European output. The highest national percentages over the European total for the period as a whole were found for United Kingdom (27.5%), which peaked in 2008, followed by Spain (13.1%), Germany (12.8%), Netherlands (6.2%) and France (5.9%). The remainder was published by small Central, Southern, Scandinavian and Western European countries. The most prominent finding for the first, most productive group was the decline in the share of the European total recorded in United Kingdom and Germany. The former slid from 39.5% in 2003 to 19.4% in 2012 and the latter from 17.1 to 11%. Spain, in contrast, grew from 3.7 to 17.8% in the same period, exhibiting the steepest rise (Chart 2). The percentages also rose, albeit less steeply, in Italy, Austria and Croatia, respectively from 2.4 to 5.8%, 2.0 to 4.2% and 0.3% (in 2004) to 2.4%.

One consequence of using percentage-based measurements of the publications produced by a given country relative to the total is that a



	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
% Northern America	54.89	58.03	56.61	56.45	53.30	51.78	48.46	49.66	43.96	43.51
% Europe	34.13	33.05	32.60	31.49	32.90	34.73	36.15	35.44	36.88	36.10
% EU-28	31.11	28.99	28.47	27.67	28.33	30.29	32.11	30.73	31.99	30.67
% Eastern Europe	1.73	1.32	2.01	2.70	2.12	1.91	2.07	2.88	3.37	3.60
% Asia	9.97	8.60	8.55	8.59	9.30	9.44	11.09	12.39	17.34	20.17
% Latin America	1.2	0.9	1.2	4.4	5.7	5.7	5.6	4.4	4.2	4.3

Chart 1. Regional breakdown (%) of worldwide publications on library and information science research in 2003–2012.

Table 1
Papers published by country (top 20 ≥ 100 papers), 2003–12.

Rank	Country	No. of papers[a] (Pw)										
		2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2003–12[b]
1	United Kingdom	281	245	320	401	404	409	371	355	399	348	3533
2	Spain	26	35	58	118	159	191	236	265	279	320	1687
3	Germany	122	125	129	150	158	179	182	179	229	198	1651
4	Netherlands	34	34	62	56	75	101	106	105	125	104	802
5	France	48	71	54	63	59	75	95	99	106	94	764
6	Italy	17	31	37	41	56	48	74	65	85	104	558
7	Belgium	32	23	35	43	47	65	64	72	70	78	529
8	Austria	14	7	15	12	17	25	52	63	82	76	363
9	Finland	30	28	23	31	47	30	32	34	53	51	359
10	Sweden	19	8	23	20	25	37	35	41	47	38	293
11	Denmark	19	22	15	24	24	37	28	32	30	48	279
12	Greece	6	5	16	24	32	45	44	32	36	36	276
13	Switzerland	8	19	20	21	32	32	31	33	33	32	261
14	Croatia	–	2	5	21	20	16	23	40	56	43	226
15	Norway	9	16	18	12	25	17	19	24	26	20	186
16	Ireland	9	9	10	17	11	18	32	21	31	24	182
17	Hungary	11	9	13	20	16	12	22	22	19	22	166
18	Portugal	1	4	6	6	9	7	10	20	22	29	114
19	Poland	4	3	7	9	8	8	9	16	22	26	112
20	Russian Federation	7	7	9	16	9	8	7	10	13	17	103
	Median	17	17.5	19	22.5	28.5	34.5	33.5	37	50	45.5	286
	EU-28	649	637	792	1014	1096	1222	1335	1364	1585	1524	11218
	Western Europe	676	697	851	1055	1191	1324	1417	1445	1660	1615	11931
	Eastern Europe	36	29	56	99	82	77	86	128	167	179	939

[a] All types; whole counting.
[b] Sort criterion.

rise in the percentage detected for growth countries automatically induces a decline in the percentage of so-called "incumbent" countries. A more accurate overview of the fluctuations in national output calls for the use of a series of indicators, for "no indicator is perfect and each denotes a specific value, characteristic or aspect of publishing activity" (Moed, 2005).

Hence, the compound annual growth rate for six indicators was found to measure library and information science publishing intensity in 20 European countries in 2003–2012. Table 2 shows the growth rates rounded to whole percentage points. Countries were ranked by their absolute annual growth rate (found using the whole counting method) shown in column 5. The values for Croatia covered from 2004 to 2012 only, for lack of data for 2003. For readier interpretation of the data, the 20 countries were divided into three categories in keeping with the values in column 5: steep, moderate and weak growth.

Table 2 shows the absolute (column 5) or relative (column 6) rise/decline in the number of papers published by authors in each country. By way of illustration for a fuller understanding of the indicators, the absolute number of papers authored or co-authored by researchers in Spain grew by a compound 29% yearly, while growth in relative terms was 17%, whereas on the other extreme, the number of papers published by UK authors rose by 2% yearly but declined relative to the European total by 7% yearly.

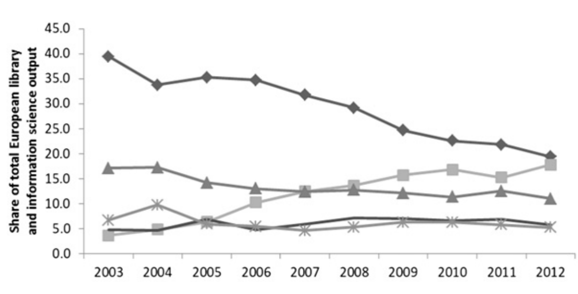


Chart 2. Most productive countries' share in total European library and information science output (whole counting).

Countries' output growth can be characterized by the difference between the values in columns 5 and 9. Much higher CAGR Pw than CAGR Ps values, such as in Croatia and Greece, denote growth with scant scientific autonomy. Where the latter is higher, such as in Poland, Switzerland and Sweden, the growth in scientific output is largely autonomous.

Table 2
Compound annual growth rate for six indicators in 20 countries, 2003–12.

1	2	3	4	5	6	7	8	9	10
Country	Abbreviation	Pw	Ps	Pw[a]	%Pw	Sp	%Sp	Ps	%Ps
Steep growth									
Portugal	PRT	114	92	40	28	21	25	36	10
Croatia[b]	HRV	226	183	36	27	6	19	3	−6
Spain	ESP	1687	1510	29	17	23	11	27	17
Poland	POL	112	90	21	10	39	9	36	29
Italy	ITA	558	473	20	9	20	9	20	11
Greece	GRC	276	223	20	9	10	7	6	−2
Austria	AUT	363	306	18	8	18	7	19	10
Moderate growth									
Switzerland	CHE	261	224	15	5	12	1	19	10
Netherlands	NLD	802	641	12	2	12	2	11	3
Ireland	IRL	182	142	10	1	12	1	8	0
Denmark	DNK	279	231	10	0	5	−1	8	−1
Belgium	BEL	529	406	9	0	9	−1	10	2
Russian Federation	RUS	103	71	9	0	2	−8	4	−4
Weak growth									
Norway	NOR	186	143	8	−1	7	−3	5	−4
Sweden	SWE	293	237	7	−2	19	−5	16	7
Hungary	HUN	166	94	7	−2	7	−3	8	0
France	FRA	764	628	7	−2	6	−4	6	−2
Finland	FIN	359	306	5	−4	5	−5	8	−1
Germany	DEU	1651	1432	5	−4	9	−2	4	−5
United Kingdom	GBR	3533	3085	2	−7	3	−7	1	−7
s.d.[c]				10.5	9.8	8.9	8.7	10.4	9.0

Pw: output (whole counting); Ps: output (straight counting); Sp: scientific pool.
[a] Sort criterion.
[b] 2004–12.
[c] s.d.: standard deviation.

The indicators showing the yearly growth rate in number of researchers publishing papers in the field by country are given in columns 7 (based on absolute values) and 8 (relative values). Note that the greatest increases in the number of researchers during the period were recorded primarily in the highest growth countries, with such rises sometimes outpacing growth in the absolute number of publications, as in Poland (39%), Spain (23%) and Portugal (21%).

The straight counting output values (column 4) provided a more reliable picture of the publishing efforts made by the researchers working in each country. Lead author output, understood as the percentage of such papers over the national total, fluctuated from highs in Croatia (96%), Spain (90%), United Kingdom and Germany (87%) Greece (86%), and Finland and Italy (85%) to lows in Hungary (57%) and Russia (69%), the only two countries with values of under 70%. While such high values of leading authorship (Ps) may appear to be infrequent, they are confirmed by the scant international partnering observed in European LIS output as a whole. The negative correlation ($R^2 = -0.802$) between these two parameters is an indication that, overall in this type of research in the top-ranking western European countries, higher lead authorship goes hand-in-hand with lower international co-authorship.

IMPACT OF EUROPEAN OUTPUT: COUNTRIES AND INSTITUTIONS

The question addressed here is position on the grounds of impact, i.e., citations received by research published. A broad range of indicators was calculated to obtain a balanced overview of impact so defined.

An initial approach to determine impact is illustrated in Table 3, which gives the normalized values of citations per paper for each country in the years studied, based on the whole counting method. The mean citation rate per paper, the essential measure for citations, affords a rough estimate of research impact. The highest mean impact recorded in each year is shaded; note the clear predominance of Switzerland and Hungary.

Six other indicators are listed in Table 4 for 20 European countries. The total number of citations, the citations per paper and the percentage of papers cited were calculated for each national output. Normalized citation (NI) values were found for 5-year series and the period 2003–12 as a whole. The final two columns show the percentage of a country's output listed by Scopus among the 10% most cited papers in the subject area, normalized to the year of publication. Two categories of highly cited papers were distinguished: a) detected with the whole counting method (%Pw_Top_10%); and b) detected with the straight counting method (%Ps_Top_10%). The highest NI values were obtained for the outputs of small European countries such as Netherlands, Switzerland and Belgium, and the Scandinavian countries, while the lowest values were found for the Mediterranean countries and France, Germany, Austria and Russia. The normalized impact indicator measures impact relative to the worldwide mean. Hence, at the upper end, Dutch papers were cited 180% ($2.8 - 1 * 100$) more frequently than the world mean in 2003–12, while Russian papers were cited 10% less than the mean.

In countries with an excellence value of over 10%, performance was higher than the expected or normalized reference value, while an excellence value of under 10% denoted lower than expected performance in terms of the number of highly cited papers (Bornmann et al., 2012).

Table 5 lists output and the impact indicators for the top 25 higher education and public research institutions that published at least 85 papers in the period 2003–12. The table shows, among others, the normalized impact (NI) value and percentage of excellent papers calculated using the whole (Pw_Top 10%) and straight counting (%Ps_Top 10%) procedures. The first three institutions listed in the table had impact values of over 3.5 and excellence rates of over 30%.

Many studies have shown that multi-authored research, particularly where international collaboration is involved, has a greater impact than findings published by a single institution (Levitt & Thelwall, 2009). Chart 3 graphs the percentage of international collaboration (horizontal axis) against the normalized impact of output (vertical axis) for the institutions listed in Table 4. The two variables proved to be closely correlated, with a linear correlation coefficient of 0.76 ($R^2 = 0.57$). The horizontal line shows the mean normalized impact calculated for all European Union (EU-28) institutions as a whole and the vertical line the mean international collaboration in the EU for the same period and discipline. The institutions with the best performance from the standpoint of normalized impact and the highest international collaboration values are located in the upper right quadrant. The Universities of Leiden, Amsterdam and Wolverhampton, the Hungarian Academy of Sciences and the Catholic University of Leuven, for instance, all had impact values at least treble the mean normalized value.

JOURNAL STATUS, PUBLICATION PREFERENCES AND IMPACT

Table 6 provides an overview of the diversity in European institution publishing practice and lists the institutions that published in the most highly reputed journals. The University of Hasselt, Leyden, and the Hungarian Academy of Sciences published over 80% of their papers in Scopus category Library and Information Science journals with the highest impact ratings and only a negligible percentage in low impact journals. In contrast, Spanish universities with the exception of U. Granada, the French National Center for Scientific Research and the University of Zagreb published fewer than 30% of their papers in Scimago Journal Rank first quartile periodicals. That score was much lower than the means calculated for the European Union and Western and Eastern European countries as a whole in 2003–12.

LIS papers authored by European Union researchers in 2003–2012 were published in 149 journals classified by Scopus under the heading Library and Information Science, while Eastern European authors published in a total of 88 journals under the same heading. The 40 journals where European Union researchers published most frequently accounted for 71% of the total output. *Scientometrics*, the *Journal of the American Society for Information Science and Technology* and *Profesional de la Información* were the three top journals by number of papers published on the discipline. Table 7 lists the percentage of highly cited papers for each journal, calculated using both the whole and straight counting methods.

Of the 149 journals carrying EU papers, 58 (39%) published at least one highly cited article authored by European Union researchers. The largest number of highly cited EU papers, 286 (32% of 892), were

Table 3
Normalized citations per paper, 2003–12.

Country	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Austria	0.2	0.4	0.2	0.1	0.1	0.3	0.4	0.3	0.2	0.3
Belgium	0.9	0.6	0.5	1.0	0.6	0.6	1.0	0.7	0.4	0.5
Croatia	0.0	0.5	0.1	0.0	0.1	0.3	0.1	0.1	0.1	0.2
Denmark	0.8	0.7	0.8	0.3	0.4	0.5	0.6	0.5	0.5	0.8
Finland	0.7	0.6	0.8	0.3	0.5	0.5	0.8	0.6	0.3	0.8
France	0.2	0.1	0.2	0.2	0.1	0.4	0.4	0.3	0.2	0.1
Germany	0.1	0.1	0.2	0.1	0.2	0.4	0.4	0.3	0.5	0.5
Greece	0.2	0.3	0.5	0.3	0.4	0.4	0.5	0.4	0.2	0.2
Hungary	0.8	1.0	0.5	0.9	1.0	0.6	1.0	0.5	0.5	0.8
Ireland	0.3	0.4	0.5	0.3	0.4	0.8	0.9	0.7	0.9	0.3
Italy	0.3	0.2	0.5	0.3	0.4	0.5	0.7	0.6	0.5	0.6
Netherlands	0.9	0.6	0.8	0.6	0.5	0.8	0.7	1.0	0.8	0.8
Norway	1.0	0.6	0.3	0.3	0.5	0.4	0.6	0.6	0.3	0.6
Poland	0.3	0.0	0.5	0.2	0.1	0.6	0.3	0.3	0.3	0.6
Portugal	0.0	0.5	0.4	0.1	0.3	0.4	0.5	0.4	0.2	0.3
Russian Federation	0.2	0.3	0.1	0.1	0.0	0.2	0.5	0.8	0.3	0.1
Spain	0.5	0.3	0.4	0.2	0.3	0.2	0.4	0.3	0.3	0.4
Sweden	0.6	0.8	0.7	0.2	0.5	0.5	0.5	0.7	0.5	0.7
Switzerland	0.3	0.6	1.0	0.5	0.7	1.0	0.7	1.0	1.0	1.0
United Kingdom	0.4	0.3	0.4	0.2	0.4	0.4	0.5	0.4	0.3	0.6

The shading denotes the highest value in each year.

Table 4
Impact of LIS papers published by authors in the top 20 European countries, 2003–2012.

Country or region	Abbrev.	Cites	Cites per paper	% cited papers	Normalized impact (NI)							%Pw_Top 10% 2003–12	%Ps_Top 10% 2003–12[a]
					2003–07	2004–08	2005–09	2006–10	2007–11	2008–12	2003–12		
Netherlands	NLD	8786	10.9	74.9	2.6	2.5	2.5	2.6	2.7	2.9	2.8	30.1	22.4
Switzerland	CHE	3090	11.8	74.3	2.5	2.7	2.6	2.5	2.6	2.6	2.5	33.3	21.8
Belgium	BEL	5691	10.7	77.7	3.0	2.7	2.5	2.6	2.1	2.0	2.3	28.5	20.4
Denmark	DNK	2465	8.8	73.4	2.5	2	1.8	1.7	1.8	1.6	2	22.2	17.2
Norway	NOR	1544	8.3	69.8	1.9	1.6	1.4	1.7	1.6	1.4	1.6	22.0	17.2
Finland	FIN	3132	8.7	75.4	2.1	2.0	1.9	1.9	1.7	1.7	1.9	22.2	16.4
Sweden	SWE	2378	8.1	74.0	1.9	1.8	1.6	1.7	1.8	1.8	1.8	22.1	16.0
Italy	ITA	3147	5.6	69.7	1.2	1.3	1.4	1.4	1.6	1.7	1.6	19.1	15.7
Ireland	IRL	1445	7.9	71.9	1.2	1.6	1.6	1.7	2.6	2.4	2.1	18.6	15.3
Hungary	HUN	2198	13.2	77.1	3.7	3.9	3.6	3.5	3.0	2.6	3.1	34.9	13.2
United Kingdom	UK	23176	6.5	70.9	1.3	1.3	1.4	1.4	1.5	1.4	1.4	14.6	11.1
Greece	GRE	1591	5.7	73.9	1.4	1.3	1.4	1.3	1.2	1.1	1.2	13.0	10.1
Poland	POL	450	4.0	62.5	0.7	0.9	1.0	0.9	1.0	1.3	1.1	13.3	9.8
Spain	ESP	6352	3.7	58.9	1.0	0.9	0.9	0.9	0.9	0.9	1	10.4	9.1
Portugal	PRT	435	3.8	60.5	1	1.1	1.1	1.2	1.1	1.1	1.1	11.4	7.8
Germany	DEU	6121	3.7	45.0	0.6	0.8	0.9	1.0	1.3	1.3	1.0	10.4	7.3
Austria	AUT	926	2.5	41.3	0.7	0.8	0.8	0.9	0.9	0.8	0.8	7.1	5.5
France	FRA	2544	3.3	47.9	0.6	0.7	0.8	0.8	0.9	0.8	0.7	8.1	5.2
Russian Federation	RUS	313	3.0	51.4	0.4	0.3	0.2	0.6	1.1	1.3	0.9	8.7	1.9
Croatia	HRV	222	0.9	32.7	0.2	0.4	0.2	0.2	0.2	0.2	0.2	1.3	0.8
EU-28		61768	5.5	62.0	1.2	1.2	1.3	1.3	1.3	1.3	1.3	13.9	13.5
Western Europe		63010	5.3	62.0	1.3	1.3	1.3	1.3	1.3	1.3	1.3	14.5	12.0
Eastern Europe		4383	4.6	56.7	1.3	1.3	1.3	1.3	1.1	1.1	1.2	13.5	7.4

%Pw_10%: percentage of highly cited papers (whole counting), %Ps_Top 10%: percentage of highly cited papers (straight counting).
[a] Sort criterion.

published in *Scientometrics*, followed by the *Journal of the American Society for Information Science and Technology*, with 267 (45.5% of 587), the *International Journal of Geographical Information Science* with 96 (31.7% of 303), *Information Processing and Management* with 91 (30.6% of 297), the *Journal of Information Science* with 46 (22.9% of 201) and the *Journal of Enterprise Information Management*, with 37 (23.9% of 155). The *SJR2012* impact values for these journals were respectively 1.437 (second of 149 journals), 1.531 (first of 149), 1.06 (fifth of 149), 0.675 (15th of 149), 1.197 (third of 149) and 0.493 (22nd of 149). The journals with the ten highest *SJR2012* values published 743 (65.7%) highly cited European Union papers: i.e., a substantial number of excellent papers were published in the journals with the top ten *SJR2012* scores. Highly cited papers were also published in journals with lower *SJR2012* values, however, such as the *Journal of Enterprise Information Management* (position 22 of 149, *SJR2012* = 0.493), *Health Information and Libraries Journal* (20/149, *SJR2012* = 0.51),

Table 5
Bibliometric parameters for the 25 most productive European institutions (≥85 papers), 2003–12

Rank	Institution	Country	No. papers (Pw)[a]	Citations	Cttns per paper	% papers cited	Normalized impact (NI)	%Pw_Top 10%	%Ps_Top 10%[b]
1	Leiden U.	NLD	128	2066	16.1	75.7	5.1	48.4	38.2
2	U. of Amsterdam	NLD	175	2759	15.7	80	4.5	50.8	35.4
3	U. of Wolverhampton	GBR	132	2200	16.6	88.6	3.5	47.7	31.8
4	Catholic U. of Leuven	BEL	227	3179	14	81.0	3.3	38.7	24.6
5	U. of Tampere	FIN	113	1224	10.8	88.5	1.9	48.6	21.2
6	Hasselt U.	BEL	97	1258	12.9	90.7	2.5	28.8	19.5
7	U. College London	GBR	167	1221	7.3	77.2	1.5	18.5	16.1
8	U. of Manchester	GBR	96	665	6.9	75	1.5	20.8	14.5
9	Hungarian Academy of Sciences	HUN	113	2064	18.2	86.7	4.2	26.5	14.1
10	U. of Sheffield	GBR	188	1235	6.5	78.7	1.4	16.4	13.3
11	Royal School of Library and Information Science	DNK	86	467	5.4	66.2	1.6	18.6	12.7
12	Spanish National Research Council	ESP	238	1620	6.8	78.9	1.8	19.3	12.1
13	Italian National Research Council	ITA	118	679	5.7	66.9	1.8	22.0	11.8
14	U. Granada	ESP	230	1512	6.5	75.6	1.5	15.2	11.7
15	Loughborough U.	GBR	200	1404	7.02	76.5	1.2	12.5	9
16	City U. London	GBR	113	940	8.3	81.4	1.3	13.2	8.8
17	Carlos III U. Madrid	ESP	134	366	2.7	60.4	0.9	8.2	5.2
18	U. Antwerp	BEL	136	1450	10.6	79.4	2.3	27.2	5.1
19	Technical U. Valencia	ESP	89	278	3.1	62.9	1.0	6.7	4.4
20	French National Scientific Research Centre	FRA	268	1014	3.7	53.3	0.9	9.7	4.4
21	U. Barcelona	ESP	96	231	2.4	54.1	0.6	5.2	4.1
22	U. Strathclyde	GBR	180	1031	5.7	75	1.1	8.8	3.8
23	U. Complutense Madrid	ESP	102	181	1.7	43.1	0.4	3.9	2.9
24	Humboldt-U at Berlin	DEU	91	189	2.0	50.5	0.4	4.4	2.2
25	U. of Zagreb	HRV	93	126	1.3	41.9	0.3	2.1	2.1

%Pw_10%: percentage of highly cited papers (whole counting); % Ps_Top10%: percentage of highly cited papers (straight counting).
[a] All types, whole counting.
[b] Sort criterion.

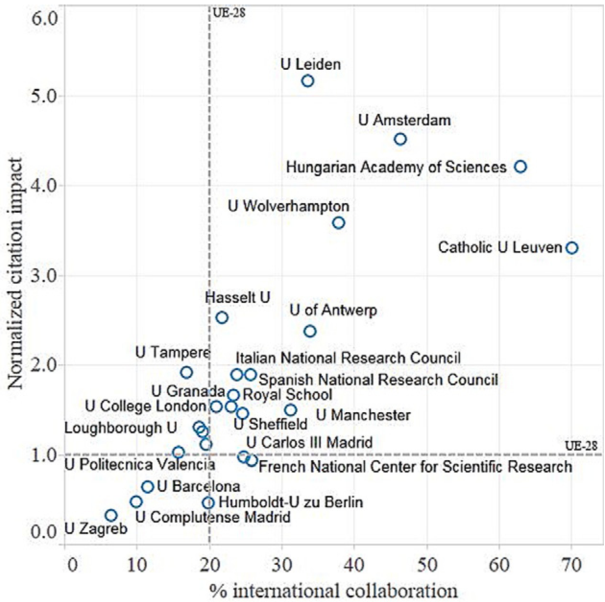


Chart 3. Normalized impact versus international collaboration (%) for 25 top European institutions (2003–12).

Research Evaluation (12/149, *SJR2012* = 0.748), *Aslib Proceedings* (13/149, *SJR2012* = 0.695) and *Information Research* (19/149, *SJR2012* = 0.55). Publishing in non-English language journals comes at a high cost in terms of impact (van Leeuwen, Moed, Tijssen, Visser, & van Raan, 2001). Support for that assertion is to be found in the low impact values and scant volume of highly cited EU countries' publications in journals issued in a national language such as German (*Information-Wissenschaft und Praxis SJR2012* = 0.185; *Zeitschrift fur Bibliothekswesen und Bibliographie SJR2012* = 0.123; *VOEB-Mitteilungen SJR2012* = 0.14), French (*Document Numérique SJR2012* = 0.11; *Documentaliste*: *Sciences de l'Information SJR2012* = 0.135) or Spanish (*El Profesional de la Información SJR2* = 0.285; *Revista Española de Documentación Científica*, *SJR2012* = 0.28) (see Table 7).

Table 6
Top 25 European institutions' output and distribution by Scimago Journal Rank quartiles, 2003–12.

Institution	Country	No. of papers (Pw)[a]	% Q4	% Q3	% Q2	% Q1
Leiden University	NLD	128	4.7	2.3	12.5	80.5
University of Amsterdam	NLD	175	14.8	6.3	8	70.9
University of Wolverhampton	GBR	132	8.3	3.0	12.1	76.5
Catholic University of Leuven	BEL	227	7.0	3.1	16.3	73.6
University of Tampere	FIN	113	6.2	4.4	19.5	69.9
Hasselt University	BEL	97	4.1		6.2	89.7
University College London	GBR	167	6.0	11.4	37.7	44.9
University of Manchester	GBR	96	15.6	9.4	27.1	47.9
Hungarian Academy of Sciences	HUN	113	1.8	0.9	13.3	84.1
University of Sheffield	GBR	188	6.4	9.0	33.5	51.1
Royal School of Library and Information Science	DNK	86	10.5	10.5	18.6	60.5
Spanish National Research Council	ESP	238	9.2	21.4	13.4	55.9
Italian National Research Council	ITA	118	5.9	6.8	16.1	71.2
University of Granada	ESP	230	11.7	23.5	15.2	49.6
Loughborough University	GBR	200	9	9.5	37	44.5
City University London	GBR	113	3.5	3.5	47.8	45.1
Carlos III University of Madrid	ESP	134	17.2	31.3	23.1	28.4
University of Antwerp	BEL	136	8.8	5.1	11.8	74.3
Technical University of Valencia	ESP	89	4.5	38.2	22.5	34.8
French National Center for Scientific Research	FRA	268	40.7	13.1	17.9	28.4
University of Barcelona	ESP	96	16.7	47.9	15.6	19.8
University of Strathclyde	GBR	180	10.0	6.7	48.3	35.0
Complutense University of Madrid	ESP	102	41.8	36.7	8.2	13.3
Humboldt-University at Berlin	DEU	91	11.0	27.5	14.3	47.3
University of Zagreb	HRV	93	55.9	18.3	11.8	14.0
EU-28		11218	10.2	15.8	27.1	47.0
Western Europe		11931	22.3	23.2	21.7	56.3
Eastern Europe		939	17.8	24.2	13.9	44.1

Q1 = first quartile or highest ranking and Q4 = fourth quartile or lowest ranking journals.
[a] All types, whole counting.

DISCUSSION

Bibliometric procedures, which entail monitoring the volume of scientific papers produced by a given institution and analyzing the respective citations, are among the most influential quantitative assessment methodologies currently in place. This approach has been widely used in the past in LIS analyses, based on simply counting citations and papers with a view to formulating professional league tables. Ten indicators were explored in the present study to characterize publishing and impact patterns in 20 European countries and 25 research institutions, including universities. Bibliometric analyses of national and institutional outputs in LIS have laid the grounds for the development and application of sophisticated indicators designed to verify the findings yielded by the respective systems and compare geopolitically and culturally similar countries and institutions in an international context. The results gleaned here from a portfolio of indicators revealed differences in LIS research performance in European countries and institutions.

Q1: PUBLISHING INTENSITY IN EUROPEAN COUNTRIES AND INSTITUTIONS

In reply to the research question posed on publishing intensity by European countries and institutions, the study found that as a whole, Europe is an active region with moderate output growth in LIS publishing relative to worldwide values (Chart 1). Such growth, which denotes the consolidation of the research teams working in the subject area, is due to a rise in publications authored by researchers in the Eastern European countries that have recently joined the European Union, such as Poland and Croatia, but also in studies published by authors in Southern European nations, including Spain, Italy, Greece and Portugal. The situation in the United Kingdom is the opposite: while it leads the European ranking by countries in absolute numbers, its growth has been nearly stagnant. The differences in the growth rates found with the two methods for determining output suggest that weak overall growth in the United Kingdom was due to a rise in international collaboration to the detriment of the number of papers with a national research guarantor. Similar situations were identified in other countries (such as Croatia and Greece) where publishing was more intense, but the research guarantor was affiliated elsewhere.

Moreover, it comes as no surprise that the list of the 25 most active European institutions in terms of (LIS) papers published includes bodies such as Spain's National Research Council (*Consejo Superior de Investigaciones Científicas*), the French National Center for Scientific Research (*Centre National de la Recherche Scientifique*), Italy's National Research Council (*Consiglio Nazionale delle Ricerche*) and the Hungarian Academy of Sciences (*Magyar Tudományos Akadémia*), for these are the respective countries' largest public research institutions by staff size.

Q2: IMPACT OF PAPERS PUBLISHED BY EUROPEAN COUNTRIES AND INSTITUTIONS

More intense publishing does not necessarily infer greater use or visibility of the content, as attested to by the high normalized impact (NI) and excellence values found for the papers published by the Scandinavian and other small European countries, which head the list in Table 4. In the period studied, simultaneous rises in output, impact and the number of authors engaging in LIS were recorded in only two

Table 7
Top 40 LIS journals by European Union output 2003–12: number of papers, cumulative percentage, percentage of excellent papers (calculated with the whole and straight counting methods) and *Scimago Journal Rank* in 2012.

Journal	Country	Total papers	% Total papers	% Δ	SJR_2012	Pw_Top 10%	%Pw_Top 10%	Ps_Top 10%	%Ps_Top 10%
Scientometrics	NLD	892	8.1	8.1	1.437	286	32.1	264	29.6
Journal of the Association for Information Science and Technology	USA	587	5.3	13.4	1.531	267	45.5	232	39.5
Profesional de la Información	ESP	503	4.6	18.0	0.285	8	1.6	8	1.6
Information-Wissenschaft und Praxis	DEU	474	4.3	22.3	0.185	4	0.8	4	0.8
Zeitschrift fur Bibliothekswesen und Bibliographie	DEU	314	2.8	25.1	0.123		0.0		0.0
International Journal of Geographical Information Science	GBR	303	2.7	27.9	1.06	96	31.7	83	27.4
Information Processing and Management	GBR	297	2.7	30.6	0.675	91	30.6	83	27.9
Aslib Proceedings	GBR	272	2.5	33.0	0.695	21	7.7	20	7.4
Health Information and Libraries Journal	GBR	258	2.3	35.4	0.51	36	14.0	34	13.2
D-Lib Magazine	USA	214	1.9	37.3	0.466	14	6.5	10	4.7
Journal of Information Science	GBR	201	1.8	39.1	1.197	46	22.9	44	21.9
Information Research	GBR	192	1.7	40.9	0.55	21	10.9	20	10.4
Research Evaluation	GBR	188	1.7	42.6	0.748	29	15.4	23	12.2
Library Review	GBR	170	1.5	44.1	0.415	8	4.7	6	3.5
Document Numérique	FRA	169	1.5	45.7	0.11		0.0		0.0
Interlending and Document Supply	GBR	159	1.4	47.1	0.823	3	1.9	3	1.9
Journal of Enterprise Information Management	GBR	155	1.4	48.5	0.493	37	23.9	33	21.3
VOEB-Mitteilungen	AUT	147	1.3	49.8	0.14		0.0		0.0
Development and Learning in Organisations	GBR	136	1.2	51.1	0.133	1	0.7	1	0.7
Journal of Librarianship and Information Science	GBR	133	1.2	52.3	0.881	8	6.0	8	6.0
New Library World	GBR	128	1.2	53.4	0.902	3	2.3	1	0.8
Revista Española de Documentación Científica	ESP	127	1.2	54.6	0.28	1	0.8	1	0.8
Journal of Cheminformatics	GBR	126	1.1	55.7	0.88	10	7.9	10	7.9
Social Science Computer Review	USA	122	1.1	56.8	0.976	16	13.1	13	10.7
Journal of Digital Information Management	IND	122	1.1	57.9	0.177		0.0		0.0
Library Management	GBR	120	1.1	59.0	0.674	2	1.7	2	1.7
Proceedings of the ASIST Annual Meeting	GBR	115	1.0	60.1	0.176	2	1.7	2	1.7
Documentaliste: Sciences de l'Information	FRA	115	1.0	61.1	0.135		0.0		0.0
Knowledge Management Research and Practise	GBR	113	1.0	62.1	0.566	8	7.1	7	6.2
LIBER Quarterly	NLD	106	1.0	63.1	0.304	2	1.9	2	1.9
Library Hi Tech	GBR	105	1.0	64.1	1.055	8	7.6	7	6.7
Knowledge Organisation	DEU	99	0.9	65.0	0.347	6	6.1	5	5.1
International Journal on Digital Libraries	DEU	95	0.9	65.8	0.508	10	10.5	10	10.5
Electronic Library	GBR	92	0.8	66.7	0.914	3	3.3	3	3.3
Vjesnik Bibliotekara Hrvatske	HRV	91	0.8	67.5	0.199		0.0		0.0
International Journal of Metadata. Semantics and Ontologies	GBR	89	0.8	68.3	0.354	4	4.5	3	3.4
Serials Review	GBR	81	0.7	69.0	0.688	2	2.5	2	2.5
VINE	GBR	75	0.7	69.7	0.29	4	5.3	3	4.0
Information Technology and People	GBR	73	0.7	70.4	0.595	15	20.5	14	19.2
Library Trends	USA	73	0.7	71.0	0.454	3	4.1	3	4.1

%Pw_10%: percentage of highly cited papers (whole counting); %Ps_Top 10%: percentage of highly cited papers (straight counting); SJR 2012: Scimago Journal Rank score in 2012.

countries, Switzerland and Sweden. The most qualitative indicator, excellence, calculated with the two approaches, distinguished between countries (and their institutions) such as Netherlands and Belgium with highly reputed researchers in the field and others where the discipline is less developed, such as Croatia, Russia, Austria, France, Germany and Spain. The highest performance in terms of publishing impact (Table 5 and Chart 3) was attained by European institutions whose members are prolific authors of papers on informetrics: Hungarian Academy of Science (Glänzel, Schubert, Braun, Vinkler and Thijs), Leyden University (van Raan, Moed, van Leeuwen and Tijssen), University of Leuven (Glänzel, Rousseau, Thijs and Meyer), University of Antwerp (Rousseau and Egghe), University of Amsterdam (Leydesdorff), and University Wolverhampton (Thelwall) (Abrizah et al., 2014).

Q3: CORE JOURNALS WHERE AUTHORS AFFILIATED WITH EUROPEAN INSTITUTIONS PUBLISH MOST PROFUSELY

Although English is the language most widely used in written scientific communications, the core LIS journals used by European authors to publish their papers include periodicals in German, Spanish, French and Croatian. This is not unusual, for non-English language European scientists tend to prefer to communicate with their national LIS colleagues in journals published in their respective native tongues. In 2003–12, 30% of the papers published by French authors were published in French, while 34% of German and 45% of Austrian authors published in German. The highest percentage of non-English papers was observed for Spain, where 55% of national output was in the Spanish language. The journals involved are not as well known in the academic community and the size and diversity of the potential readership that might make use of the findings they publish are smaller than in English language periodicals. Furthermore, when listed in international databases such as Scopus, they are often classified in the fourth quartile on the grounds of their impact. Papers published in non-English language journals generally have a low normalized impact and are scantly able to attain citation-based excellence. The foregoing translates into lower impact scores than reached by countries and institutions that publish in international library and information science journals.

From the outset, bibliometric indicators have met with doubts about their validity and a certain degree of scepticism. While they are quantitative and apparently objective, their underlying theoretical grounds have not been sufficiently established due to the ambiguity implicit in the significance of citations. They have also been viewed as somewhat coarse and imprecise measures. Moreover, the data tabulated in this paper would appear to imply a prevalence of the institutions or countries listed in the tables. However, the indicators calculated do not prejudge the findings on ranking by impact that could be obtained from other indicators drawn from the same or similar databases, using alternative techniques for counting co-authored papers, specific methods for normalizing values, other levels of analysis (research groups or individual researchers, for instance), or presenting data in different ways (representations showing relational information among countries or institutions, for instance).

The method chosen, which must consequently be construed as an approximate scheme for measuring the intellectual influence in the field exerted by such countries or institutions, is subject to the following limitations. Some academic institutions with no library and information science department, for instance, may publish in journals listed in the Scopus database. Highly specialized institutions may not have a large enough output to appear on a list based on the criteria chosen and yet publish papers with a substantial impact on the speciality. This would be the case of Switzerland, where the intense nationwide activity is not mirrored in institutional values. Hence, due to the minimum output criterion applied, no Swiss institutions appear in the tables. Moreover, the method is subject to indexing errors or flaws in the affiliation addresses used to attribute papers to countries or institutions. Although the analysis was based on a large data set, the items were taken from journals only, which is but one of the vehicles used in inter-researcher communication. From the institutional perspective, the values of frequently cited papers that determine a high rank for a given institution may be due to research published by a single author who may have since changed affiliation. That institution's position would, then, reflect results pertaining to the past. Lastly, library and information science research is a smallish subject area in Europe, measured in terms of citations, and bibliometric indicators deliver more representative values when applied at higher levels of aggregation.

The foregoing is nonetheless no obstacle to identifying possible lines of continuing research. Contemporary research is conducted in collaboration. This article furnishes data on international partnering, but the information is insufficient to fully portray the nature of the interaction among European authors in international collaboration networks, particularly as regards inter-institutional networks.

CONCLUSIONS

The above analysis of LIS output by researchers affiliated with European institutions is based on the use of bibliometric productivity and impact indicators. Although Europe is a prominent research region, to date its national and institutional contribution to LIS had been insufficiently described. The relevance of this study lies in the comparison afforded of the finest knowledge in this subject area. The differences in country productivity may be related to a number of factors, such as research experience and intensity, number of institutions and, in short, the historic, economic, cultural and linguistic patterns that characterize the publishing practice identified by indicators. Researchers who write in English may be encouraged to publish by the existence of a substantial number of English language journals or journals published in the United Kingdom. In addition, the differences in the requisites and rewards in university and public research institutions' incentive systems may steer researchers in different directions: one example is to be found in the requirements governing the number of papers published and their characteristics to be taken into consideration in professional reward and promotion processes. The scores attained by institutions' values may in fact mirror differences in research objectives. The lack of stimulus for excellence in national journals affects the indicators for the scientific communities publishing in them. Moreover, indicators are calculated without bearing in mind research findings deriving from papers published in other than the international journals listed in a single database, which may affect the results obtained. Determining the reasons that might explain countries' or institutions' publishing profiles and impact would call for a detailed analysis to understand researchers' specific behaviour. That, in any event, lies beyond the objectives that inspired the present study.

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