

Impact of the Consumption of Electronic Contents on Research Productivity in Some Portuguese and Spanish Universities

Blanca Rodríguez-Bravo¹, Luiza Baptista Melo^{2,3}, Teresa Costa²

¹Library and Information Science Department. University of Leon, Spain. E-mail: blanca.rodriguez@unileon.es

²CIDEHUS - B b b b Ab b L b N b b
I -mail: teresa.costa.23@gmail.com.

³ Library of Faculty of Science. University of Porto, Portugal. E-mail: lbmelo@fc.up.pt

Abstract: The aim of this study is to investigate the link between the use of electronic resources and the academic output of researchers in 10 universities of Portugal and Spain in the period 2007 to 2012. As for Portuguese institutions, data are analyzed from N b bb F b a I : b ; b B b M -os-Montes and Alto Douro. As for Spanish institutions data are taken into account from Universities of Burgos, Leon, Salamanca, Valladolid and Vigo.

The analysis of the consumption of contents distributed to the mentioned universities will be undertaken from downloads of four suppliers whose materials are widely used: IEEEExplore, ScienceDirect, SpringerLink and Wiley. In investigating academic output, the databases Web of Science (WoS) from Thomson Reuters and Scopus from Elsevier will be taken into account.

From previous studies we know that the consumption of electronic academic contents shows an upward trend since the Big Deals were hired by the consortia B-on in Portugal and BUCLE and Bugalicia in Spain. We want to check if this upward trend is also a reality in the academic output.

The paper main aim is to investigate the connection between the access to a wider range of journals and a higher international academic output. The analysis will differentiate disciplines, compare the situation of Portugal and Spain and study the research collaboration between both countries.

Keywords: Academic libraries, Electronic journals, Information consumption, Scientific productivity, Web of Science, Scopus, Portugal, Spain

1. Introduction

This paper is part of the studies about of the consumption of electronic information, specifically, articles from electronic journals whose availability has increased significantly with the subscription of packages under the licensing model known as Big Deal which helped to increase significantly the use of these contents in response to the preferences of the users (Sanville, 2001).

Many studies about the consumption of electronic journals have been carried out in English-speaking countries, taking as their starting point the downloads statistics provided by the publishers. In the context of the Iberian Peninsula, which is the region covered by the present paper, it is possible to highlight several studies that can be considered as a starting point for the current study ! -Bravo and Alvite-)**4 -Bravo, Alvite-Barrionuevo-Almuzara, 2012). Similarly, there has also been produced some research concerning the connection between the consumption and output of scientific information by Portuguese and Spanish researchers (Costa, Vaz and :) * 4 -;) * 4 ; : b - 2013).

The main aims of this study are to know if the increasing trend in the usage verified on the Iberian area is still a reality in the new decade, and if the increasing availability on the number of journals and subsequent increase in consumption is reflected in the increase of the scientific production of the researchers from the analysed universities.

2. Objectives and Methods

The purpose of this study is to look into the relation between the use of electronic resources and the academic output by researchers in ten universities from Portugal and Spain. It covered the period from 2008 to 2012.

This work investigated a group of ten public universities in Portugal and Spain. The criteria for choosing these institutions was geographical. These universities are all located relatively close to each other and are situated in the Spanish regions of Galicia and of Castile and Leon, and the Portuguese regions of F b a Eb M -os-Montes and Beira Interior.

In relation to the Portuguese universities, the data analysed were from the Universities of Minho, Porto, Av b ; b B b M -os-Montes e Alto Douro. In respect of the Spanish institutions the data came from the Universities of Burgos, Leon, Salamanca, Valladolid and Vigo.

The analysis of the consumption of electronic journals was based on downloads from four suppliers whose contents were available in all ten universities: IEEXplore, ScienceDirect, SpringerLink and Wiley. An analysis was undertaken of overall downloads of articles from these publishers.

Three of the considered suppliers are multidisciplinary, although they focus predominantly on the areas of natural, health and pure sciences. This is the case of ScienceDirect, Springer and Wiley. However, downloads from a specific supplier specialized in engineering, IEEE, were also studied.

To investigate the research output of the academic communities considered, we use two databases: Web of Science (WoS) from Thomson Reuters and Scopus from Elsevier. These are the main international multidisciplinary databases.

To gather data on the academic output, searches were carried out with the term Univ* combined with Burgos, Leon, Salamanca, Valladolid, Vigo, Aveiro, ; b B b F b a I M -os-Montes e Alto Douro.

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The data on research personnel of the universities studied, as shown on Table 1, allow to see of the differences in the size of the institutions investigated, which naturally has consequences on the data for usage and for scientific output.

Table 1 – Numbers of Teaching and Research Staff

University	2008	2009	2010	2011	2012
Burgos	688	718	727	739	724
Leon	950	988	1,093	1,039	936
Salamanca	2,453	2,485	2,483	2,468	2,356
Valladolid	2,514	2,574	2,918	2,863	2,464
Vigo	1,754	1,858	1,848	1,935	1,453
Aveiro	957	957	983	983	1,015
Beira Interior	460	460	628	628	664
Minho	1,331	1,331	1,171	1,171	1,172
Porto	2,281	2,281	2,321	2,321	2,398
Tras-os-Montes and Alto Douro	593	593	558	558	550

* Spain - Data obtained from the database of the Spanish National Statistical Institute (INE) and, for 2012 from the databases of the Government of the Autonomous Region of Castile and Leon and of the University of Vigo.

* Portugal - Data obtained from the Portuguese Directorate-General for Higher Education (DGES)

In the case of the Spanish universities, the institutions studied were of different sizes, as may be observed from the data relating to their numbers of academic staff. The sample was made up of two large universities, Salamanca and

Valladolid, one medium-sized institution, Vigo, one small establishment, Leon, and one very small university, Burgos. Burgos, Leon, Salamanca and Valladolid all belong to the Autonomous Region of Castile and Leon and their university libraries have collaborated, becoming part of the BUCLE consortium. In the case of Vigo, the university lies within the region of Galicia and the academic library is part of the Bugalicia consortium.

The Portuguese universities were also of several sizes. The University of Porto is the largest in Portugal, Aveiro and Minho are medium-sized universities, ab ; b B b M -os-Montes and Alto Douro are small. The five universities are part of the b-on consortium.

3. Data Processing and Analysis

The parameters and indicators established for the investigation were the following:

1. Consumption of information in the universities studied, as derived from data on downloads of articles:
 - The number of articles downloaded each year by the Portuguese and Spanish institutions.
 - The number of articles downloaded annually from each publisher in the Portuguese and Spanish universities.
2. Output of articles included in international databases:
 - Output in the WoS database coming from the Portuguese and Spanish universities.
 - Output in the Scopus database coming from the Portuguese and Spanish universities.
3. Ratios of use and productivity per hundred research staff in WoS:
 - The ratio between articles downloaded and the teaching and research staff in each institution.
 - The ratio between articles indexed and the teaching and research staff in each institution.

3.1 Overall Figures for Downloads, 2008 to 2012

The following tables show the data for downloads from each distributor made by the Spanish and Portuguese universities.

Table 2 - Total Downloads per Year by the Spanish Universities from Each Publisher

Publisher	2008	2009	2010	2011	2012	Total
IEEE	37,422	29,840	38,276	37,269	41,604	184,411
ScienceDirect	540,746	587,450	606,806	658,955	669,744	3,063,701
Springer	65,380	69,397	72,259	104,846	78,121	390,003
Wiley	57,523	63,211	101,500	125,887	133,934	482,055

Table 3-Total Downloads per Year by the Portuguese Universities from Each

Publisher	2008	2009	2010	2011	2012	Total
IEEE	137,568	167,492	65,501	72,554	58,275	501,390
ScienceDirect	1,274,0	1,525,0	1,273,3	1,785,6	2,079,7	7,937,865
Springer	126,472	180,178	495,000	346,490	279,621	1,427,761
Wiley	103,212	116,306	217,048	287,648	313,909	1,038,123

Publisher

It may be observed from Tables 2 and 3 that in both countries the package of contents most frequently used was ScienceDirect and the least used was IEEE. The Portuguese universities showed a certain preference for Springer regarding Wiley, while in the Spanish institutions considered the situation was the opposite.

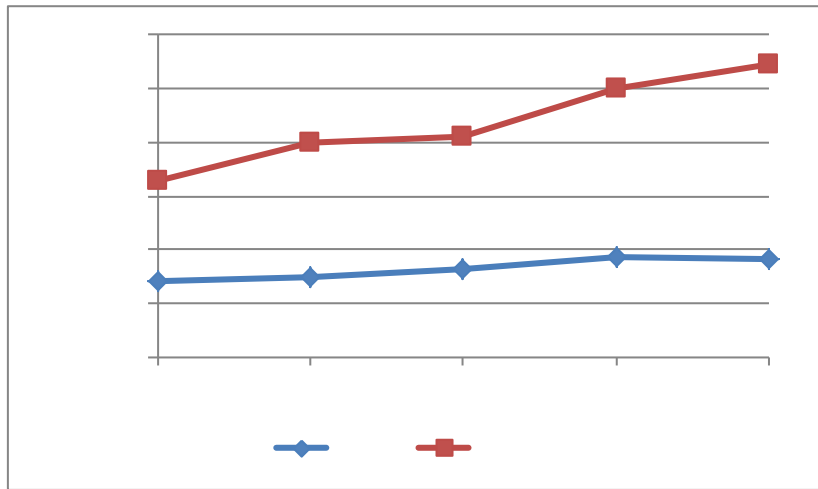


Figure 1 Total Downloads for Spain and Portugal Year by Year

A comparison of the number of downloads by Spanish universities with the Portuguese institutions (Figure 1) shows that there was more intensive use by the Spanish.

Similarly, and regarding the data for the five years studied, consumption of information in Portugal seemed to have a clearly upward trend. In Spain, however, consumption appeared to have reached a stable state.

3.2 Overall Figures for Academic Output 2008 to 2012

In respect of the numbers of academic articles recorded in the multidisciplinary databases WoS and Scopus, it was possible to see that the figures for yearly production of articles in the five Spanish universities were very similar in the two databases. In the case of the Portuguese universities there was a greater imbalance in the data, as a noticeably larger number of articles were indexed by Scopus than by WoS.

Table 4 - Output from the Spanish Universities Indexed in WoS and Scopus

Year	University of Burgos		University of Leon		University of Salamanca		University of Valladolid		University of Vigo	
	Articles Indexed		Articles Indexed		Articles Indexed		Articles Indexed		Articles Indexed	
	WoS	Scopus	WoS	Scopus	WoS	Scopus	WoS	Scopus	WoS	Scopus
2008	117	116	253	268	701	601	594	541	631	608
2009	114	126	262	291	656	621	588	527	669	653
2010	130	136	249	294	720	654	587	555	836	826
2011	146	148	296	332	756	685	648	619	853	841
2012	179	173	375	363	812	807	709	724	861	857
Total	686	699	1,435	1,548	3,645	3,368	3,126	2,966	3,850	3,785

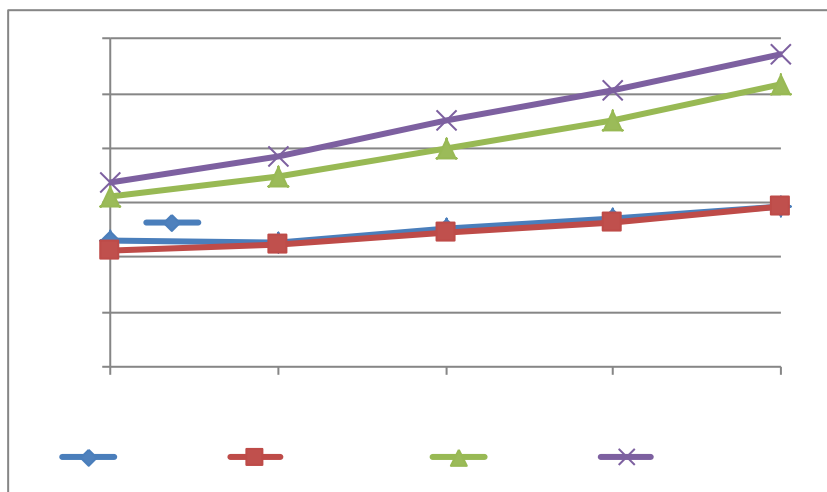
Table 5 - Output from the Portuguese Universities Indexed in WoS and Scopus

	University of Aveiro	University of Beira Interior	University of Minho	University of Porto	University of Trás-os-Montes and
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Year	Articles Indexed		Articles Indexed		Articles Indexed		Articles Indexed		Alto Douro	
	WoS	Scopus	WoS	Scopus	WoS	Scopus	WoS	Scopus	WoS	Scopus
	2008	918	921	92	121	596	587	1,379	1,545	112
2009	940	970	139	168	658	702	1,610	1,769	145	245
2010	1,022	1,044	157	212	781	860	1,815	2,059	217	325
2011	1,121	1,049	189	268	880	985	2,045	2,423	271	349
2012	1,231	1,166	260	341	1,069	1,192	2,330	2,725	284	288
Total	5,232	5,150	837	1,110	3,984	2,149	9,179	10,521	1,029	1,415

It is noteworthy that there was clear growth in the amount of output indexed by the databases considered from all the universities (Tables 4 and 5). The large number of articles coming from the University of Vigo was particularly striking, as it was larger than the totals from the Universities of Valladolid and of Salamanca. Similarly, the considerable number of indexed articles proceeding from the University of Porto was striking.

Figure 2 Total Academic Output from Spain and Portugal Year by Year



3.3 Ratios for Use and Productivity Recorded in WoS per Hundred Research Staff

In order to weight the overall raw data for use and output, these were re-expressed as a number per hundred research staff in the universities studied. The ensuing relative figures are shown below.

Table 6 - Use and Productivity in the Spanish Universities

University	2008		2009		2010		2011		2012	
	Use	Output	Use	Output	Use	Output	Use	Output	Use	Output
Burgos	8,359.44	17	8,400	15.87	10,340.30	17.88	11,002.57	19.75	12,266.98	24.72
Leon	13,342.10	26.63	7,599.08	26.51	9,246.02	22.78	13,880.84	28.48	10,783.01	40.06
Salamanca	5,789.97	28.57	5,639.07	26.39	8,123.39	28.99	9,699.87	30.63	11,000.25	34.46
Valladolid	6,351.35	23.62	7,037.95	22.84	6,746.23	20.11	7,564.65	22.63	7,898.01	28.77
Vigo	12,263.79	35.97	15,781.43	36	13,206.11	45.23	14,235.50	44	19,262.76	59.25

Table 7 - Use and Productivity in the Portuguese Universities

University	2008		2009		2010		2011		2012	
	Use	Output	Use	Output	Use	Output	Use	Output	Use	Output
Aveiro	37,869.70	95.92	50,550.78	98.22	45,428.38	103.97	52,971.72	114.04	65,003.35	121.28
Beira Interior	22,061.09	20.00	21,437.17	30.22	15,477.87	25.00	18,878.66	30.10	23,247.74	39.16
Minho	23,816.83	44.78	28,314.80	49.44	34,765.93	66.70	39,989.33	75.15	43,081.57	91.21
Porto	33,579.75	60.46	40,297.33	70.58	43,049.33	78.20	54,368.03	88.11	52,753.67	97.16
Tras-os-Montes and Alto Douro	15,933.73	18.89	18,654.47	24.45	18,066.85	38.89	22,028.14	48.57	26,808.36	51.64

In respect of the consumption of electronic information shown in Table 6 it should be noted that the University of Vigo made intensive use of such resources. The figures for total downloads and for the ratios per hundred research staff were both higher than those for the Universities of Salamanca and of Valladolid, institutions of greater size. The data for use relating to Leon and Burgos were also very positive if compared with those from the two large universities.

Valladolid, institutions of greater size. The data for use relating to Leon and Burgos were also very positive if compared with those from the two large universities.

In the case of Portugal (Table 7) the greatest levels of use corresponded to the first and third universities by size, Porto and Aveiro respectively. Nonetheless, the situation in the University of Aveiro was noteworthy, as its weighted figures for consumption of academic contents were higher than those of the University of Porto.

With regard to the weighted data for output of articles, within Spain these ratios were higher for staff at the University of Vigo than for those in all the universities in Castile and Leon in every year. Likewise, it should be noted that the figures for the University of Salamanca and even those for the University of Leon were higher than those for the University of Valladolid in all the years considered. The University of Burgos was the University with the lowest output ratios.

Furthermore, it is of interest to observe that the University of Aveiro also outstripped the University of Porto in weighted figures for academic output, although the second was of greater size. Nonetheless, this latter university also boasted a large production of articles. The greater output of academic articles by researchers at the University of Aveiro was confirmed and these results have been already reported in other studies (Melo, 2012).

A further point to be noted is the strong growth in academic production in the University of Minho, where ratios doubled during the period analysed. The Montes and Alto Douro.

4. Conclusions

It was observed that the upward trend in consumption of electronic information that was triggered by the greater availability of academic information through packages subscribed to since a decade ago is still continuing. Nonetheless, it is stronger in Portugal than in Spain, where a certain degree of stability appears to have been reached.

The subscriptions held by b-on, covering the whole of Portugal were clearly being made good use of, at least by the universities investigated here. In the case of the Spanish institutions, the data obtained were more uneven. The results show that the group of Portuguese universities analysed were more active than the set of Spanish universities considered, in terms both of information consumption and of academic output.

In the case of Spain, the most intense use and greatest output corresponded to the Galician University of Vigo. In the case of Portugal, the results for the University of Aveiro were the most striking. Those for the University of Porto were also very positive.

In respect of preferences for suppliers, all the universities made intense use of contents from ScienceDirect. With regard to the other two similar suppliers studied, preferences in the two countries differed. Portuguese researchers were more inclined to use Springer, whilst Spaniards were more favourable to Wiley. As for the specialist supplier, IEEE, use in Spain was at a merely token level.

Studies about the consumption of academic information in electronic format and output of papers by researchers are keys to assessing the value in monetary terms for subscriptions to *Big deal*. It is important to know the return on the investments and assess the impact of the universities on the society.

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