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Approach to self-publishing with a combination of bibliometric study and social network analysis techniques

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Abstract

Purpose – From the point of view of the book chain, self-publishing is becoming increasingly common and it is doing so faster in the commercial world than in science. This study aims to analyse the phenomenon of self-publishing from the point of view of the research being done on it. Thus, in addition to studying the subject, it is going to be possible to analyse the viability of this methodology as an analysis technique.

Design/methodology/approach – The methodology is based on a combination of traditional bibliometric studies and analysis of social networks applied.

Findings – Self-publishing is a phenomenon that is being studied by the scientific community. But the research on this topic has a low rate of co-authorship and a low relationship between the most prolific authors and their relevance. The combination of techniques used has proven to be a very good choice for analyzing the data.

Originality/value – There are not enough works analyzing the research in self-publishing. Because of the peculiarities of the topic, a combination of various techniques will provide a better approach to its study, so, this paper contains some results using bibliometrics and others using social network analysis applied.

Keywords Bibliometrics, Social network analysis, Self-publishing

Paper type Research paper

Introduction

To be effective, scientific communication must be both immediate and easy without sacrificing tested quality. While these are two of the advantages of publishing as a way of editing books (Cerdón-García and Alonso Arévalo, 2010), the lack of quality review and editing makes many experts consider self-publishing to be unsuitable for scientific publications (Mangas-Vega, 2014).

There is no doubt that a phenomenon of this magnitude (Alonso Arévalo *et al.*, 2014) requires study by the scientific community. But, is the potential of this phenomenon for scientific publishing being taken into account? Is the multidisciplinary points of view involved being analysed? How deeply are the experts working on this issue? These questions drive the current study.



When conducting a study on this issue, the implications of the terminology for this phenomenon should be considered in the different territories and languages: “autopublicación”, “autoedición”, “vanity publish” or “self-publish” (Sullivan, 1958). This study examines “self-publishing” (“auto-publicación” in Spanish), which Cordón-García *et al.* (2013) defined as publishing something for oneself without going through any type of control, external evaluation or editing apart from the author’s own reviewing.

Because of the peculiarities of the topic, a combination of various techniques will provide a better approach to its study. First, bibliometrics are used from the field of metric information studies (Gorbea Portal, 2005), as it is intended to analyse scientific activity around a particular topic based on the application of mathematical and statistical indicators regarding bibliographic production and its authors (Camps, 2007). Second, social network analysis is used, which has proven to be increasingly effective in all types of subjects and in different aspects of information science and documentation (Ardanuy *et al.*, 2009; Carroll *et al.*, 2010; Chang, 2011; Mangas-Vega, 2015; Miguel *et al.*, 2008).

Objectives

Based on a short previous study of the phenomenon of publishing (Mangas-Vega, 2015), this paper aims to determine whether the results obtained in that study hold for a wider range of data and with different perspectives of study which analyse the highlights of the study and research that has been done on self-publishing over the years. The same points of that approach will be analysed, with particular attention being given to recent times, in which self-publishing appears to have undergone a resurgence. This study offers an additional benefit of combining bibliometric study with social network analysis to analyse larger ranges of data than were previously possible because of hardware limitations (such as some excessive hardware requirements and software applications timing).

Literature review

Self-publishing is a growing phenomenon. At the commercial level, its dissemination and development have witnessed a significant rise in recent years. In fact, new elements and new agents have emerged along the book chain, and some institutions, such as Amazon, are beginning to enjoy undisputed authority. In the scientific world, where the immediacy of data, open access and mass communication is critical, self-publishing can be a great ally. However, its application in this field is still much slower than in the commercial world. Research on scientific publishing is lacking and that on scientific self-publishing is practically non-existent (Mangas-Vega, 2015).

Bibliometrics has been used as a reference for measurements in the information and documentation field for over 50 years (Gorbea Portal, 2005; Price, 1963). Its effectiveness is supported by its permanence in time and the relevance that the results have to science today. However, new techniques from other areas have emerged and can be applied to documentation studies to provide more meaningful data. The analysis of applied social networks is one such new technique (Jalalimanesh and Yaghoubi, 2013; Kim and Barnett, 2008) despite the technical difficulties (in most cases) forcing to choose small studies of specific elements within a network, such as most prolific authors, most

relevant authors, affiliate countries, areas of knowledge and so forth. As a result, combining both to create an approach to self-publishing research would be quite useful.

Methodology

A new literature review was conducted taking into account the terms coined over the years to refer to the phenomenon now known as “self-publishing” to determine the best search terms for the stated objective. Also included were the names of those companies, platforms or systems that are working on publishing, even if on a purely commercial basis, considering, in each case, the relevance distortion or noise they produced in search results. The final search was defined as follows:

- *Terms*: [“autopublicación” OR “auto publicación” OR “auto-publicación” OR “self-publishing” OR “self publishing” OR “selfpublishing” OR “vanity press” OR “selfpress” OR “self-press” OR “self press” OR “vanity publishing” OR “Kindle Direct Publishing” OR “Barnes and Noble”].
- *Fields*: [Subject OR Title OR Keywords].
- *Dates*: All years.

For comparison purposes, the same databases were reviewed that were used in the study by [Mangas-Vega \(2015\)](#): Web of Science (WOS) from Thomson Reuters, SCOPUS from Elsevier, LISA from ProQuest and LISTA from EBSCOhost. Because of the high differences between the data found in each database, it was necessary to work with a single one. Finally, the resource chosen was WOS. The data collection was conducted during the month of October 2015.

As in the [Mangas-Vega \(2015\)](#) study, two searches were conducted to define the WOS database, the first in “all databases” and the second in “the main WOS databases”. This distinction was necessary because WOS provides different data based on the selection; for all database records, WOS offers citation analysis, but with regard to its main databases, WOS adds additional data that are of great help in completing a more comprehensive bibliometric analysis.

It was necessary to verify whether the difference in records located using both strategies was small enough to be able to choose the second option without losing reliability. The result was as follows: 166 records in “all databases” versus 139 in “main databases”. This represents a validity of 83.7 per cent, and this percentage is even higher when some studies identified using the first search strategy were found to have incomplete data. Based on these findings, it was decided to extract data from the “main databases”, also called “main collection WOS”. In fact, the pattern of results was very similar to that in the previous study ([Mangas-Vega, 2015](#)). The same indicators and elements that were discussed in the 2015 study were used in the analysis, deepening those cases where significant differences appeared in the data.

For the application of social network analysis, it was necessary to implement work files with the new data that could be recognised and managed by the chosen software. It must be noted that it was decided to use the same software used in the 2015 study to avoid distortions in the results ([Figure 1](#)).

Results and discussion

According to [Price \(1963\)](#), on assessing the number of scientists who have studied the phenomenon, and adding all of those who have existed in the past to the sum of the

present, it can be observed that the number of scientists from the past is so small that it is almost irrelevant in proportion to the current number of scientists working on the issue.

After performing and combining different searches, the data were analysed. Working on the assumption set forth by authors [Furtado \(2012\)](#) and [Charman-Anderson \(2012\)](#), among others, indicating that self-publishing is a current and trendy subject (and will continue to grow, acquiring a graphical way to Gartner Hype Cycle) but with an ancient birth, the decision was made not to limit by year of publication to confirm whether these theories are true.

The data were analysed on the basis of the laws and indicators that bibliometrics provides: evolution over time, contemporary science, dispersion of scientific literature, law of productivity of authors, co-authorship index, application of social network analysis.

Evolution (growth/decline) over time

In this case, evolution refers to both the appearance of the publications and their citation. Arguably, the emergence of a “sustained” study on self-publishing began in 1996. Although some prior articles have been discovered in this study, they have very little significance. It was only from the 1990s onward that research on the issue began to appear more frequently. In addition, these years witnessed an increase in the diversity of issues covered in the articles.

While it is true that minor differences can be found between the graph of the previous study ([Mangas-Vega, 2015](#)) and the present, most of those changes occurred in recent years, which can be explained because the databases have been updated since the previous study.

Although the graphs show a decline in the past two years, 2014 cannot be taken as the saturation limit proposed by [Price \(1963\)](#) for the law of exponential growth of the scientific literature because it is extremely recent. In addition, the number of published works has not fallen significantly; therefore, it is quite possible that, in the coming years, the number of citations will remain consistent or will increase. In fact, this has happened before, such as in 2009, when no newly published works appeared in the data but citations neither disappeared that year nor the following year, indicating that it was an issue that was gaining notoriety.

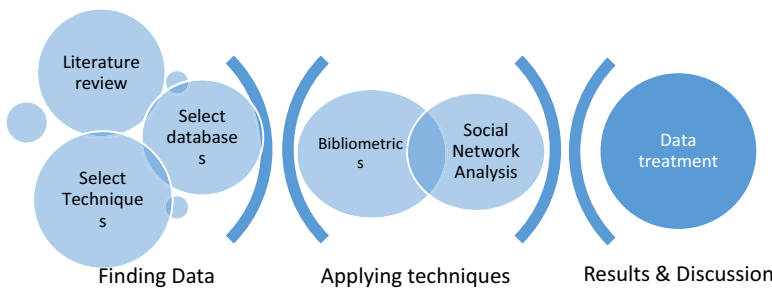


Figure 1.
Methodology process

Contemporary science

On assessing the number of scientists who have studied the phenomenon, Price (1963) noted that the number of scientists who conducted studies in the past is so small that it is almost irrelevant in proportion to the current number of scientists working on the issue. In this case, a total of 193 authors have investigated this issue over 55 years. However, the number of authors in the past 13 years (25 per cent of the total time) is 148 (76.6 per cent of the total authors).

Although from the initial study in March 2015, the data have changed slightly, with an increase of 53 authors (27 per cent) that resulted in a decrease in the percentage of the authors of the past 13 years of about 8 per cent, the theory is fully proven. The growing number of authors who have studied this issue in recent years has grown exponentially. This represents up to 76 per cent of the authors found in the final quarter of the progress of the phenomenon through time. From these data, it can be concluded that a limit on this growth has not yet been reached[1].

Dispersion of scientific literature (core journals)

The data generated a list of 120 journals in descending order of the number of articles on the subject. Applying Bradford's Law (formulated in 1948, about the exponentially diminishing returns of extending a search for references in science journals) in this case, we find that 17 journals have published 30 to 33 per cent of the articles. Thus, the core is 17 journals, which will be the most sought after by the authors to publish their work and are usually more specialised. Perhaps, one might even say, many items are concentrated in a few journals; specifically, the first 7 (only 5.83 per cent of total journals) account for 20.14 per cent of the articles on this topic. According to this first zone, the core is, in particular, the 17 journals shown in Table I.

Compared with previous study data, updating the database has increased the total journals to 33 per cent (40 journals more); as a result, the core has also been increased by 35 per cent (6 journals more). However, with respect to the titles of journals, there is almost no difference. It is again proven that the number of articles remained identical, whereas the number of journals increased.

Dispersion zones are as follows:

- Zone 0 (core) = 17 journals = 46 articles.
- Zone 1 = 42 journals = 46 articles.
- Zone 2 = 61 journals = 47 articles.
- Total: 120 journals = 139 articles.

The distribution is not at all in proportion to Bradford's 1: $n: n^2$, so a progression to confirm the trend of clear dispersion cannot be observed in this case.

However, implementing the Bradford Law allows us to see how there is a central core of journals with great production on the highly concentrated issue; in fact, it is possible to even identify a sub-core within the initial group. It seems clear that there is a group of journals that have opted for this topic and encourage the publication of related articles. On the other hand, the research groups taking the lead in investigating "self-publishing" may be highly concentrated and usually publish articles only in those particular journals.

Titles of journals from core journals	Regs	(%) of the 139 articles	Titles of more cited journals	No. of citations of the articles
<i>Learned Publishing*</i>	7	5.036	<i>Management Science</i>	184
<i>Technical Communication</i>	4	2.878	<i>MIT Sloan Management Review*</i>	98
<i>Proceedings of SPIE</i>	4	2.878	<i>Strategic Management Journal</i>	49
<i>Econtent</i>	4	2.878	<i>European Journal of Operational Research</i>	35
<i>Publishing Research Quarterly*</i>	3	2.158	<i>Journal of the American Society for Information Science</i>	34
<i>Progress in Human Geography</i>	3	2.158	<i>Journal of Management Information Systems</i>	19
<i>Library Journal</i>	3	2.158	<i>Journal of Computer Information Systems</i>	18
<i>TLS The Times Literary Supplement</i>	2	1.439	<i>Proceedings of the National Academy of Sciences of the United States of America</i>	17
<i>Sewanee Review</i>	2	1.439	<i>Decision Support Systems</i>	16
<i>Psychologist</i>	2	1.439	<i>Learned Publishing*</i>	11
<i>Overland Nation</i>	2	1.439	<i>Nature</i>	7
	2	1.439	<i>Journal of Contemporary Ethnography</i>	6
<i>MIT Sloan Management Review*</i>	2	1.439	<i>Library & Information Science Research*</i>	6
<i>Library Trends</i>	2	1.439	<i>Pattern Analysis and Applications</i>	6
<i>Library Quarterly</i>	2	1.439	<i>Publishing Research Quarterly*</i>	6
<i>Library Information Science Research*</i>	2	1.439	<i>Library Hi Tech</i>	5

Note: *Journals in both rankings

Table I.
Journals with more
published works and
with most cited
works

In any case, the Bradford Law addresses the most prolific journals, but to define the most relevant publications on the subject, so, it should also be analysed in which of those journals appear the most cited papers.

The fact that these publications are among the most cited could be an indicator of editorial quality when selecting the work to be published. Although this situation is seen in several cases in the core journals, it is noteworthy that the most cited article (which presupposes it as the most important) is in a publication (*Management Science*) that has published only one article on this topic, which raises the question: Is this occasional success or editorial quality?

Another trend that is discovered after applying Bradford's Law is the fact that, while the number of subjects increases, the categories do not vary. To confirm this information, the theory of social network analysis can be applied to draw a map for areas with the software Pajek and VOSViewer. To make the density of each of the materials clearer, VOSViewer has been used, using specific tools (Leydesdorff, 1989).

As seen in the initial study, these graphs show that self-publishing is a subject primarily studied in the area of information science/library science (as defined by WOS). While articles appear in many other diverse categories, such as those related to information technology, chemistry or medicine, the area of information sciences has laid the foundations of this phenomenon from a scientific point of view. From this area, results can be obtained (or should be obtained) that confirm its profile as a tool, method, subarea and so forth.

It is noteworthy that, if the top ten results are taken and contrasted with the Spanish [Agencia Nacional de Evaluación y Prospectiva \(ANEP\) \(2016\)](#) areas[2], 80 per cent of the areas where this phenomenon is being studied are within the formerly called "social sciences and humanities" area. If the tested sample is extended to 23 (setting the minimum range of items by category 2), the percentage remains high at 69.65 per cent. This result may be obvious given that self-publishing is a way to communicate something that falls within the more "social" nature of knowledge, but it could also indicate a very interesting trend for the community of social sciences in general, as its implementation could fill important gaps in the channels of dissemination of scientific knowledge in this area and, more specifically, in the areas of evaluation and metrics of social science.

This finding emphasises that only the first category, information science/library science, now covers 28 per cent of the articles, as the density map showed. This is a topic with a very concentrated scientific literature by subject.

Law of productivity of authors

According to the [Lotka \(1926\)](#) Law, the number of authors who published n papers is inversely proportional to n^2 . Therefore, a few authors publish most of the relevant literature on the subject. The formula is: $A^n = A^1/n^2$, with A^1 being the number of authors with only one published work. In this case, it should be that: $A^4 = 170/(4)^2 = 10.6$. The result is $\neq 2$ (the result of the analysis) or that $A^2 = 170/(2)^2 = 42.5$. Again, the result is $\neq 4$ (the result of the analysis; note that it is ten times lower).

In this case, the bibliography of the subject does not comply with the Lotka Law[3]. Because of the result and, as happened in the previous study, it was decided to apply the calculation provided by Price to the Lotka Law:

[Number of prolific authors = set of authors who have published half of the work]

In this case:

Total of authors: 183 authors.

Lotka's Law: $\sqrt{183} = 13.52$.

Based on this understanding, the first 13 or 14 authors should have published 50 per cent of the articles; however, in testing this hypothesis, we noticed that this table must be taken with some caution. One of the most significant shortcomings of this database is the lack of standardisation authorities, especially the non-English-speaking journals. On the different data collection dates, the database returned similar results (matching 72 per cent) but altered the order of the authors. In these cases, the authors had not increased their production on this issue, but the database's position has been improved. On the other hand, special characters in names have presented problems for the database, which did not attribute the article to any author and instead considered the author anonymous. From among all possible options, it was decided to show one in which the most common authors appear in all decision data (Figure 2). The first 13 shown in Figure 3 have 31 items, the 22.30 per cent, far from the 50 per cent indicated by the Lotka Law. Considering that the second of the "authors" is "anonymous" and it is possible this could be four different authors, it is likely that the actual percentage is significantly lower. This law is not met.

The low-productivity data indicate that this is an issue on which various authors are investigating, but about which very few are delving into it deeply. These low figures could also indicate few research groups. For further information on these assumptions, the authorship was checked for the articles of the 13 authors: 1 is "anonymous" (although these articles were not removed, they cannot be taken into account without reservations) and found that the remaining 12 authors (co-authors) fell into only three groups, the following: Baverstock-Iskandarova-Blackburn, Baverstock-Steinitz and Slatter-Hunter-Greig.

In comparing the most prolific authors with those that received more citations (the most important), the most prolific authors were not the most cited. In fact, only three authors appear on both lists (Zheng, X; Yao, DQ; and Walstrom, KA) and, in all three cases, the author had produced only one paper, precluding all three from the most prolific category. Applying social network analysis will allow us to expand data about this finding.

Co-authorship index

In this case: Total of authors: 183/Total of articles: 139.

Co-authorship index = 1.31.

These data are well below 2.9, which, according to statistics, is the international average in 2014 for documentation/information science (www.coauthorindex.info).

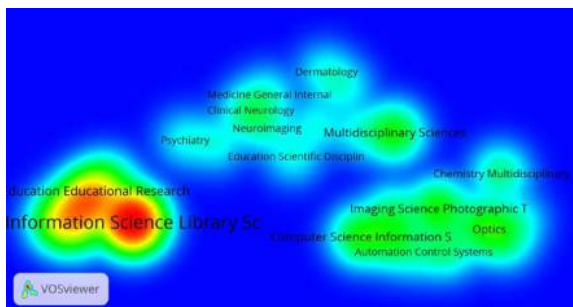


Figure 2.
Map of density of clusters (categories of WOS)

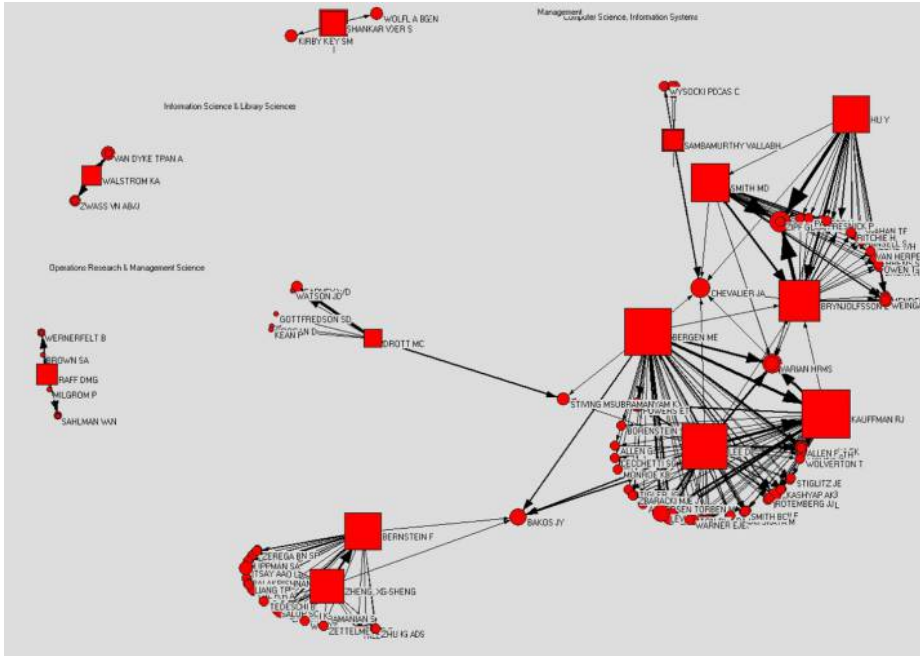


Figure 3.
Degree centrality
with weights
(input/output). Pajek

It is strange to find such a low rate of co-authorship on a topic that is a worldwide occurring phenomenon. It is not a small issue geographically or socially, and it is too broad a subject for such a low co-authorship coefficient. This does raise the issue of whether current projects are taking into account all the factors involved in the phenomenon of self-publishing. These data could mean that little collaboration exists. Here again we find a fact that lends itself to further research of great interest, namely, why do we see this overwhelming lack of cooperation? Studying collaborations in the area of science always provides an additional and interesting point of view (Maltrás, 2003).

Application of social network analysis

In this case, the analysis of social networks will be applied to the citations among the authors of the most relevant articles (defined as those who have received more citations) and also to the subject areas assigned by WOS to these articles during data collection (during October 2015).

Before turning to the analysis, it is considered necessary to focus on the fact that the analysis data networks belong to an extremely small sample, which, as presented, may not produce conclusions extrapolated to the total set. Even so, it serves to show the usefulness of this type of analysis, and some of the results can be compared to the parallel bibliometric study to verify its success even in such small samples.

After using Pajek with journal articles collected in 2015 WOS and displaying it with the Kamada–Kawai layout, these are the results:

- *Size*: 181 nodes. Total number of lines (links): 502 arcs (relation “citations”) and 46 edges (relation “categories”).
- *Number of links whose weight is different from 1* = 67. That is, in 67 cases (13 per cent), the author cites another author more than once. This confirms that there are few authors who are deepening with several papers on the subject, as indicated by data from the bibliometric study.
- *Number of loops*: 7. In seven cases, the author quoted himself. This finding also supports the above assumption.

“*Relations*” were extracted separately, and the data of the relationship “categories” that indicate the category WOS assigned to the articles studied (the most cited) are observed:

- *Density*: 0.05. The density is low, indicating that WOS does not assign too many categories to each article.
- *Average Degree* = 0.508. This indicates that there is a wide variety of categories assigned; otherwise, it would be lower.
- *Input Degree*: All categories assigned to items with more citations appear in a similar percentage. This contrasts the findings from the bibliometric study; although the category of information science/library science is most prominent, it is not among the most cited (the most important) articles on the theme. This may indicate that, although authors in this category produce many articles, they do not have the depth or the right point of view to be “relevant”.

Then, the second relationship, “cites”, will be discussed beginning with some results:

- (1) *Average Degree*: 5.54. These data are very high for the few authors who are being analysed as “authors cite”. For such a small network, it would be normal to approach 1.
- (2) *Density*: 0.57. This is again a fairly high figure for such a small network.
- (3) *Input Degree*: 10 different groups appear:
 - authors with 0 inputs (nobody quoted them) = 20;
 - authors with 1 input (citation) = 17;
 - authors with 2 inputs = 9;
 - authors with 3 inputs = 109 (the largest group);
 - authors with 4 inputs = 1;
 - authors with 5 inputs = 17;
 - authors with 6 inputs = 7 (Bakos, JY; Bils, M; Brynjolfsson, E; Brown, JR; Clay, K; Morton, FMS and Varian, HR); and
 - authors with 9 inputs = 1 (Chevalier, JA).

This makes Chevalier, JA, according to the analysis of social networks, the most cited author in the most important items, that is, someone whose work we should follow closely if we are studying this issue. However, he is an author who, according to the bibliometric study, after analysing all the issues, is not on any relevant position.

Other interesting facts are:

- (1) *Degree centrality with weights (inputs)*: Meaning who is best placed in terms of links received (inputs). In this case, three groups appear:
 - 1 with a value of 10 (Berry, LL);
 - 4 with a value of 12 (Brynjolfsson, E; Chevalier, JA; Clay, K; Kauffman, RJ); and
 - 1 with a value of 15 (Hausman, JA).

The author best positioned in this case is Hausman, JA. This finding reveals that Hausman is the author most cited by other authors and with a number of meaningful quotes; as such, this author seems to be very relevant. In this case, this author did appear in the bibliometric study but in a less highlighted or important position as in the analysis of social networks:

- *Degree centrality with weights (inputs/outputs)*: Best positioned nodes taking into account the relationship between citations emitted and received.

The most significant authors in this calculation, in order of importance are Kauffman, RJ; Bergen, ME; Lee, D and Brynjolfsson, E. We found that Kauffman, RJ, in addition to being relevant by the citations received and by whom citations proceed from, also has a good balance on the quantity and quality of citations emitted in the articles:

- *Closeness*: Which node is better related concerning the number of citations received/emitted, (it is about quantity, not relevance). In this case, there are 12 authors with a higher degree of closeness to others: Kauffman, RJ; Lee, D; Bergen, ME; Bakos, JY; Brynjolfsson, E; Brown, JR; Chevalier, JA; Clay, K; Morton, FMS; Bils, M; Stiving, M; and Varian, HR.

Most of them are authors that have arisen in the different calculations of the analysis, so we can establish a relationship between the most relevant authors and the relevance of the authors they have cited.

It has also been found that these authors do not correspond with those appearing as most prolific on the subject and who were already discussed in a previous study (Mangas-Vega, 2015). So, the social network analysis applied in the information science field provides important data regarding other study techniques overlooked. In our case, some authors who went unnoticed in a traditional bibliometric study have proved to be highly relevant in the scientific community working on this issue.

Conclusions

Self-publishing is a phenomenon that is being studied by the scientific community. Despite appearing in different areas from where it has been studied, the library and information science field is where the largest numbers of these items are listed. However, a study using various techniques (bibliometrics and applied network analysis) indicates that prominence is not obvious when it comes to the most relevant articles, those who have obtained more citations. The distribution of the authors of the most relevant articles about the relationship appointments suggests that this is because of the lack of a multidisciplinary approach in the articles. For example, this approach highlights Kauffman, RJ, and Lee, D, whose articles only have the category of information science/library science, but other categories, like management, have relevant authors whose articles both include citations from relevant authors and are cited by those authors.

The findings reveal two situations that stand out: the low rate of co-authorship in the work on the subject and the practically null relationship between the most prolific authors and their relevance or among the most important authors and the number of their works on this topic. These data cast serious doubts on whether the self-publishing phenomenon is being studied with the depth and multidisciplinary approach that it deserves given its wide range of applications. The data suggest that it is not.

Concerning the techniques used, despite the difficulties identified in this study (such as the high load time and hardware resources required by software applications for social network analysis), the combination of both techniques has again proved to be ideal and has allowed us to see more data than would have been obvious with only one approach.

Based on this analysis, a new research avenue has emerged which will be addressed in the future: comparing the results of this analysis with other approaches and studying whether the terminological problems affect the penetration of this phenomenon in society (and scientifically), among others.

Notes

1. Because there have been localised articles of 2011 and 2012 WOS that have been entered in the database between March and October 2015, we can assume that they can still be missed for introducing more items and more authors who have worked on this issue for the past 13 years. This assumption increases the idea of contemporaneity that provides the data available to us.
2. Classification of human knowledge in 26 areas by the Spanish National Agency for Evaluation and Prospective (ANEP). It is available at: www.idi.mineco.gob.es/portal/site/MICINN/menuitem.8ce192e94ba842bea3bc811001432ea0/?vgnnextoid=d2bbe7c85ab4d210VgnVCM1000001d04140aRCRD
3. It is important to note that one of the “authors” who has four items is “anonymous”, which is possibly because of an error with the names of the original authors, but, in any case, it cannot be assured in question of a single author. Reviewing the data provided by WOS, we noticed enough similarities between three of the four items to keep these records and keep “anonymous” in second place.

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