

Bibliometric View over the Online Social Networks Field

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Abstract

As bibliometrics analysis is one of the most common used technique when dealing with the evolution of a specific field, this type of analysis have been used in this paper for offering a proper view of the social networks evolution, with accent on the online social networks area. Using the Web of Science (WoS) search engine, a series of papers focusing on the social networks' studies have been extracted and analysed. Therefore, all of the five citation indexes covered by the WoS Core Collection have been considered for conducting this analysis. More than 70000 papers have been analysed form both the social networks and OSN area, underlying the fact that the social networks/OSN area is a continuous growing area, gathering year by year new researches/ researchers from all around the world. Even more, the citation metrics are strengthening this area's continuous growing due to their higher number from one year to another.

Keywords: online social networks, analysis, bibliometrics, h-index, citations analysis.

1. Introduction

The online environment have become the meeting point for people from all over the world, changing information at a glance on all life aspects, all of these being possible due to both people commitment to the online social networks and rapid development of the Web 2.0 technologies (Delcea et al., 2014; Cofas, 2013, Cofas and Roxin, 2013).

Using a visualization software, for example Gephi 0.8.2 and conducting a very simple analysis on a series of Facebook networks, it can be seen that these networks are coming in different shapes and sizes. An example of such networks visualization can be seen in Figure 1.

Over the years, a series of studies have been conducted on the social networks analysis, from which the online social networks (OSN) area is an important part. Therefore, some of the main focusing areas when dealing with online social networks can be grouped in:

- A. Social Aspects of the OSN – such as:
 - a. social capital (Ellison et al., 2007),
 - b. privacy issues and disclosure (Lewis et al., 2008; Nosko et al., 2010),
 - c. age differences (Pfeil et al., 2009),
 - d. social activity and social action (Cheung et al., 2011; Cheung et al., 2010),

- e. addiction and behaviours (Kaus and Griffiths, 2011; Benevenuto et al., 2009).
- B. Learning (Greenhow and Robelia, 2009; Yu et al., 2010),
- C. Marketing and Communication:
 - a. word-of-mouth communication (Brown et al., 2007),
 - b. viral marketing (Subramani and Rajagopalan, 2003)
- D. Economics:
 - a. companies' financial performance (Schniederjans et al., 2013),
 - b. online public goods (Wasko et al., 2009).
- E. Medicine:
 - a. medical professionalism (Thompson et al., 2008; Guseh et al., 2009),
 - b. patients' communication (Greene et al., 2011)
 - c. patient-doctor relationship in OSN (Bosslet et al., 2011), etc.

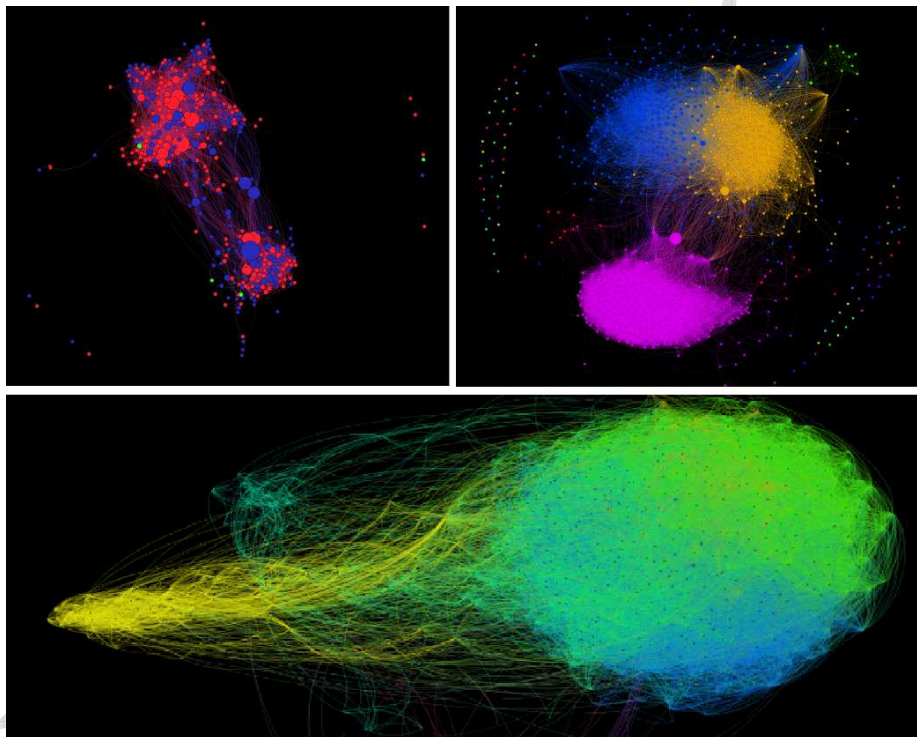


Fig 1. Different personal networks visualization using Gephi 0.8.2.

The paper is organized as it follows: Section 2 presents a short bibliometric analysis on the social networks field, while the Section 3 focuses on the OSN area and presents some indicators such as: no. of papers written, no. of citations, evolution of the field, provenience countries, papers' language, type of papers, etc. Section 3 presents a citation analysis and makes a short review of the OSN papers. At the end, some conclusions are drawn and a short list of references is presented.

2. Perspectives on Social Networks' Bibliometrics

As bibliometrics analysis is one of the most common used technique when dealing with the evolution of a specific field, this type of analysis have been used in this paper for offering a proper view of the social networks evolution, with accent on the online social networks area.

Using the Web of Science (WoS) search engine, a series of papers focusing on the social networks' studies have been extracted and analysed. Therefore, all of the five citation indexes covered by the WoS Core Collection have been considered for conducting this analysis:

- Science Citation Index Expanded (SCI-EXPANDED);
- Social Sciences Citation Index (SSCI);
- Arts & Humanities Citation Index (A&HCI);
- Conference Proceedings Citation Index- Science (CPCI-S);
- Conference Proceedings Citation Index- Social Science & Humanities (CPCI-SSH).

As a result of the search using the “social networks” keywords, 64672 papers have been selected, among which, 12687 papers were containing the “social networks” words-combination in the title.

As the resulting number of papers was quite large and some of the papers were only referring to the social area, excluding the networks field, only the papers which had the keyword combination in the title have been kept and, in the following, the Bibliometric analysis will be strictly related to these papers.

Therefore, the main research areas in which these papers have been written are listed in the Table 1 below:

Table 1: The research areas of the papers written on social networks

RESEARCH AREAS	RECORD COUNT
COMPUTER SCIENCE	3684
ENGINEERING	1586
PSYCHOLOGY	1367
BUSINESS ECONOMICS	1245
SOCIOLOGY	988
TELECOMMUNICATIONS	739
PUBLIC ENVIRONMENTAL OCCUPATIONAL HEALTH	653
EDUCATION EDUCATIONAL RESEARCH	538
INFORMATION SCIENCE LIBRARY SCIENCE	533

SOCIAL SCIENCES OTHER TOPICS

427

OTHER AREAS

927

Graphically, the articles are distributed on the research areas as in Figure 2:

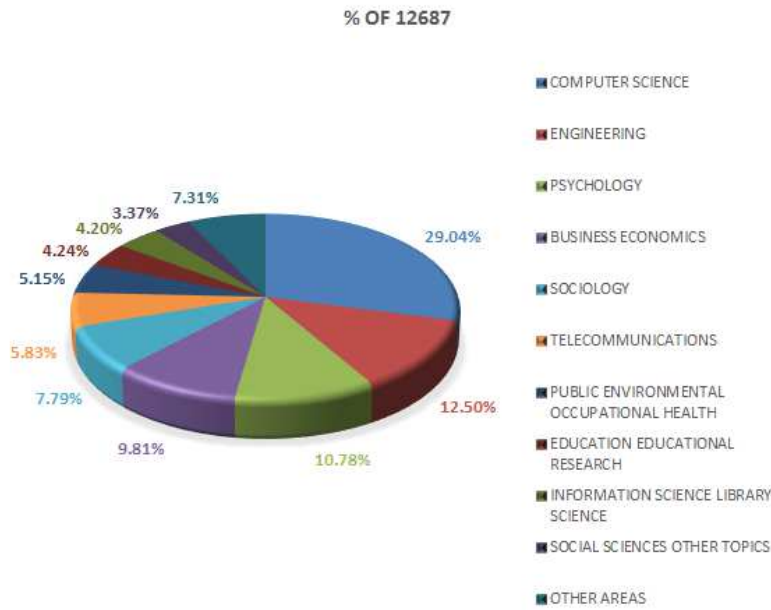


Fig 2. The percentage of social networks articles in different research areas

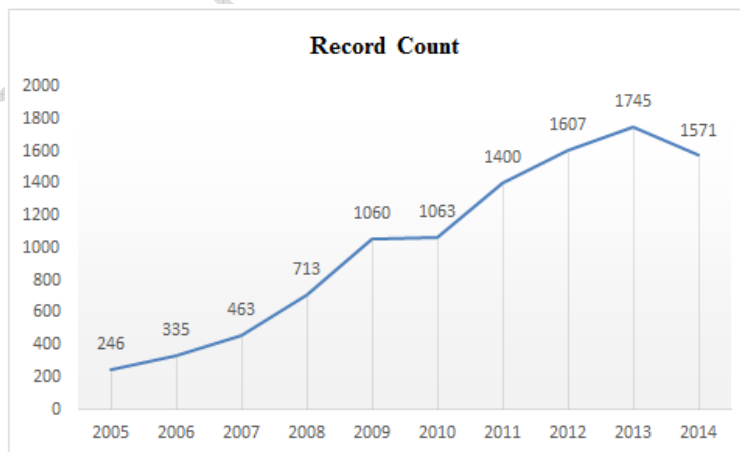


Fig 3. Record count vs. publication year

As pictured in Figure 3 it can be seen that the publication number starting from 2005 to 2014 has an increasing trend, with a peak in 2013, when it has been published 1745 articles on this topic.

More, these 12687 papers can be divided into several categories based on the document type (see Table 2). Therefore, it can be seen that the great majority of the papers were articles (55.569%), followed by proceedings papers (29.329%), book reviews (5.738%), meeting abstracts (5.431%), editorial materials (2.916%), reviews (1.710%) and a few papers are letters (0.520%), news item (0.426%), corrections (0.386%) and notes (0.323%).

Table 2: Document types of the WoS papers

DOCUMENT TYPES	RECORD COUNT
ARTICLE	7050
PROCEEDINGS PAPER	3721
BOOK REVIEW	728
MEETING ABSTRACT	689
EDITORIAL MATERIAL	370
REVIEW	217
LETTER	66
NEWS ITEM	54
CORRECTION	49
NOTE	41

As for the countries or territories from where these papers are originating, the United States of America own the great majority with 40.07% of all the papers, Peoples Republic of China (9.33%), England (7.72%), Canada (4.78%), Germany (3.72%), Spain (3.61%), Australia (3.60%), Italy (2.66%), Netherlands (2.52%) and South Korea (2.40%). Figure 4 above is picturing the record count for each of these countries.

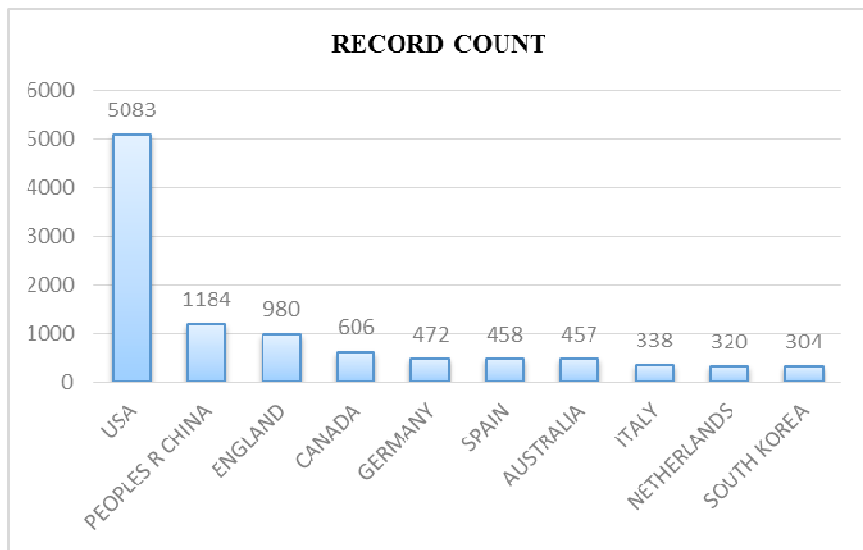


Fig 4. Record count for each country

Another analysis of the published papers can be done with regards to the language of these publications. Table 3 is showing the record count for each language and it can easily be seen that most of the papers are written in English (95.74%), while the rest of 4.26% comes from the papers written in Spanish (1.18%), German (1.14%), French (0.57%), Portuguese (0.52%), Chinese (0.24%), Japanese (0.10%), Russian (0.09%), Italian (0.07%) and Norwegian (0.07%).

Table 3: The language of the papers published on social networks

LANGUAGE	RECORD COUNT
ENGLISH	12146
SPANISH	150
GERMAN	145
FRENCH	72
PORTUGUESE	66
CHINESE	31
JAPANESE	12
RUSSIAN	11
ITALIAN	9
NORWEGIAN	9

Among the most cited papers over the time, Girvan and Newman (2002) have the greatest number of citations (2569) for the “Community structure in social and biological networks” paper. In this

paper, the authors are highlighting a new property that can be found in social networks, along with the well-known: small-world property, power-law degree distribution and network transitivity, namely the community structure property. More, the authors are also proposing a method for detecting such communities taking into account the community boundaries. The results are concluding and they are supported by a two-network example.

3. Online Social Networks Research in Numbers and Figures

The online social networks research is a specific part of the social networks, counting 6028 papers that have in topic the “online social networks” keywords. Among them, 823 contain this word combination in title and, in the following, the present chapter is going to focus only on these papers as they are surely strictly related to the online social networks field.

Considering the areas in which the journals or conferences that have hosted these papers are registered, Table 4 below is presenting their distribution. In can be seen that even in the online social networks’ case, the computer science field is taking the first place, followed by the engineering field. It should be noted that, depending of the specific of the journal/conference, a paper can be framed in more than one research area. Figure 5 is presenting the percentage of each research area in total papers published on online social networks field.

Table 5: Research areas for the online social networks’ papers

RESEARCH AREAS	RECORD COUNT
COMPUTER SCIENCE	418
ENGINEERING	181
TELECOMMUNICATIONS	103
PSYCHOLOGY	68
BUSINESS ECONOMICS	52
EDUCATION EDUCATIONAL RESEARCH	50
INFORMATION SCIENCE LIBRARY SCIENCE	44
COMMUNICATION	38
HEALTH CARE SCIENCES SERVICES	31
PHYSICS	30

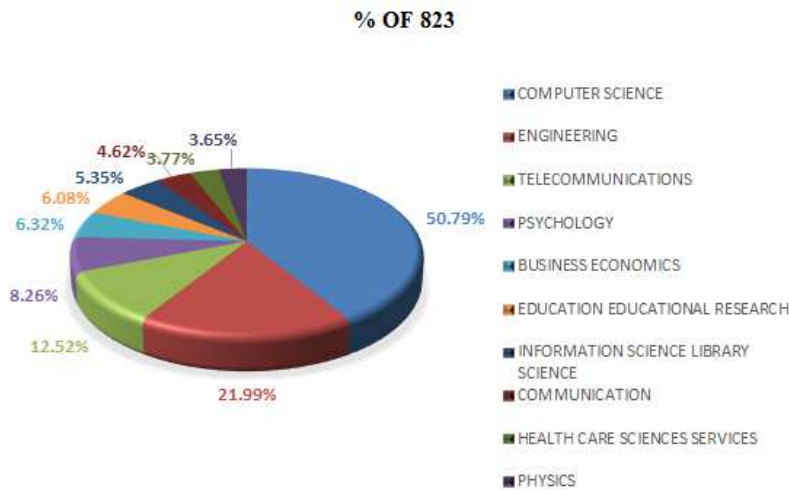


Fig 5. The percentage of online social networks articles in different research areas

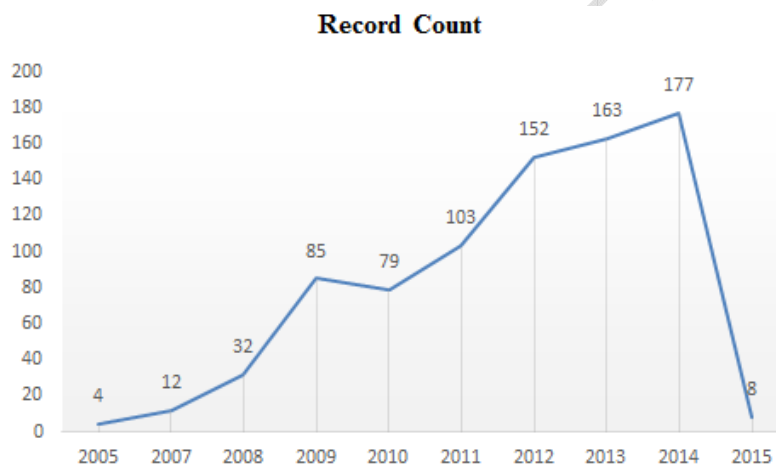


Fig 6. Record count vs. publication year (online social networks papers)

After representing the 823 papers versus their publication year (see Figure 6), it can be seen that the publications in this field are following an ascending trend, having its trend in 2014. As the analysis is conducted at the beginning of the 2015 (more specifically, February 2015), the 8 publications from the graphic are not significantly relevant for the analysis.

The most frequent papers' type is the article published in journals (counting 52.248% from all the papers published in this area), followed by the proceedings papers (39.733%), meeting abstracts (3.281%), editorial material (1.701%), book review (1.215%), review (0.972%), letter (0.608%), news items (0.486%), corrections (0.365%) and bibliographical item (0.122%). Table 6 below is presenting their actual number published in each of these categories.

Table 6: Document types of the WoS online social networks papers

DOCUMENT TYPES	RECORD COUNT
ARTICLE	430
PROCEEDINGS PAPER	327
MEETING ABSTRACT	27
EDITORIAL MATERIAL	14
BOOK REVIEW	10
REVIEW	8
LETTER	5
NEWS ITEM	4
CORRECTION	3
BIOGRAPHICAL ITEM	1

Taking into account the geographical distribution of the papers' authors, it can be concluded that most of the papers are from the United States of America (30.004%), followed by peoples Republic of China (17.618%), England (4.739%), Germany (4.374%), Canada (4.010%), Australia (3.402%), Taiwan (3.281%), Spain (2.795%), South Korea (2.430%) and Italy (2.066%).

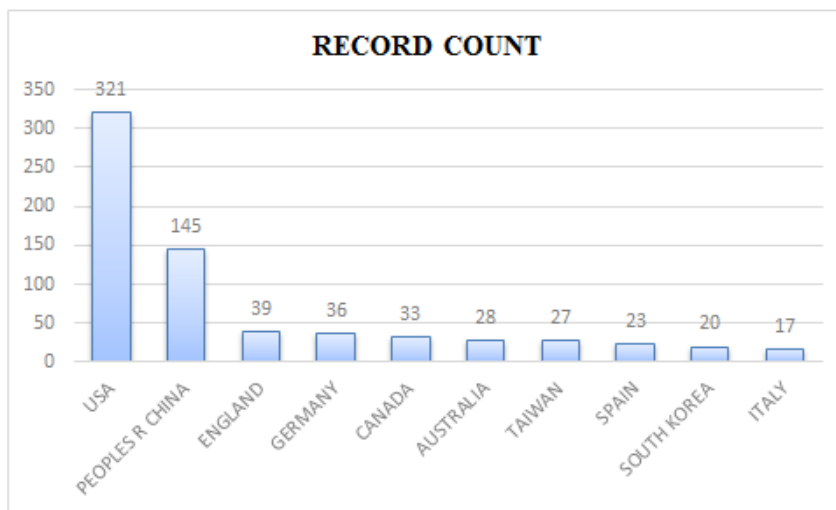


Fig 7. Record count for each country in the online social networks papers case

As in the case of the social networks' papers, even in the online social networks' case the great majority of papers are written in English (98.420%) and the rest of 1.580% in Spanish (0.486%),

Chinese (0.365%), Dutch (0.122%), French (0.122%), Hungarian (0.122%), Norwegian (0.122%), Russian (0.122%) and Turkish (0.122%). Table 7 is summarizing the number of papers written in each language.

Table 7. The language of the papers published on social networks

LANGUAGE	RECORD COUNT
ENGLISH	810
SPANISH	4
CHINESE	3
DUTCH	1
FRENCH	1
HUNGARIAN	1
NORWEGIAN	1
RUSSIAN	1
TURKISH	1

Through a comparative analysis, it can be seen (Figure 8) that the ascending trend is present in both the evolutions of the number of papers written on social networks (SN) and online social networks (OSN). The peak has been reached in 2013 for the SN papers, with a total of 1745 papers, while for the OSN the peak was in 2014, 177 papers, showing that this area is one of interest for researches from all around the world.

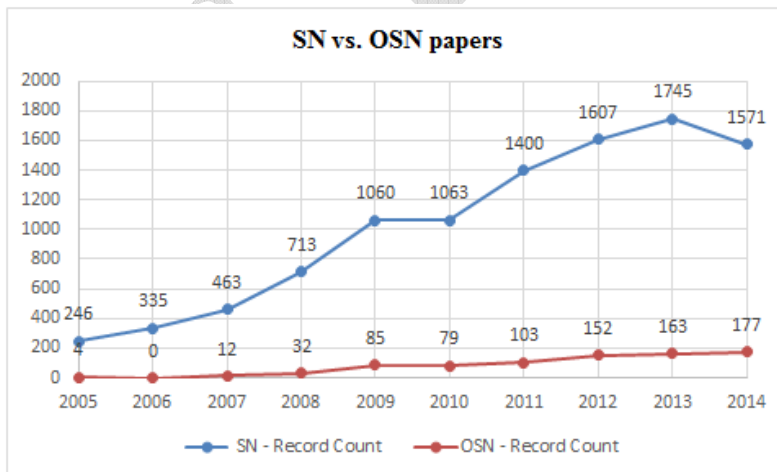


Fig 8. Record count: SN vs. OSN papers

4. Online Social Networks Research – a Citations’ Analysis

Regarding the citations gathered for the 823 papers considered representative in the online social networks research, the WoS database was also used. From here, it has been established that these OSN papers were cited 4889 times, 4422 of them being citations without self-citations. The number of papers that have cited these OSN papers is 3728, among them 3448 papers were articles without self-citations.

Therefore, the average citations per item are 5.94, while the h-index is 34. The h-index indicator of such a value is showing that, in this case, the selected set of papers is containing at least 34 papers that have received at least 34 citations each. (Merigo et al., 2014)

More, an average citations per year of 325,93 has been reached, 9 paper having more than 100 citations and an average citations per year greater than 12.75. These papers are also summarized in Table 8.

Table 8. Top 9 best cited papers on online social networks

No.	TITLE	AUTHOR/ AUTHORS	YEAR	TOTAL NO. OF CITATIONS	AVERAGE CITATIONS PER YEAR
1	The Spread of Behavior in an Online Social Network Experiment	Centola, Damon	2010	250	41.67
2	Social capital, self-esteem, and use of online social network sites: A longitudinal analysis	Steinfeld, Charles; Ellison, Nicole B.; Lampe, Cliff	2008	236	29.50
3	Measurement and Analysis of Online Social Networks	Mislove, Alan; Marcon, Massimiliano; Gummadi, Krishna R.; et al.	2007	187	20.78
4	Online and offline social networks: Use of social networking sites by emerging adults	Subrahmanyam, Kaveri; Reich, Stephanie M.; Waechter, Natalia; et al.	2008	161	21.12
5	Word of mouth communication within online communities: Conceptualizing the online social network	Brown, Jo; Broderick, Amanda J.; Lee, Nick	2007	148	16.44

6	The intersection of online social networking with medical professionalism	Thompson, Lindsay A.; Dawson, Kara; Ferdig, Richard; et al.	2008	133	16.62
7	Multirelational organization of large-scale social networks in an online world	Szell, Michael; Lambiotte, Renaud; Thurner, Stefan	2010	129	21.50
8	The benefits of Facebook "friends": Social capital and college students' use of online social network sites	Ellison, Nicole B.; Steinfield, Charles; Lampe, Cliff	2007	128	14.22
9	The Taste for Privacy: An Analysis of College Student Privacy Settings in an Online Social Network	Lewis, Kevin; Kaufman, Jason; Christakis, Nicholas	2008	102	12.75

The most-cited paper of Centola (2010) starts from the idea that “networks with many clustered ties and a high degree of separation will be less effective for the behavioural diffusion than networks in which locally redundant ties are rewired to provide shortcuts across the social space” (Centola, 2010) and proves that individual adoption is much more likely when participants received reinforcements from a higher number of their neighbours.

A more practical approach is the one of Steinfeld et al. (2008) which are conducting a longitudinal analysis on the social capital, self-esteem and the use of online social networks. Starting from some of the previous researches in the field, the authors emphasize the role of Facebook use on the social capital achievement by using a combination of survey methods and in-depth interview with a small number of students. Focusing on both the Facebook use and the psychological well-being aspects and bridging them with the social capital, the authors concluded that due to the communication facilitated by Facebook, especially in initial social interactions, as it mitigates fears of rejection, the lower self-esteem students appear to gain more from their use of Facebook than higher self-esteem students. (Steinfeld et al., 2008) Other studies that can also be pointed here: personality and motivations associated with Facebook use (Ross et al., 2009), college students' social networking experience on Facebook (Pempek et al., 2009), grey social networks with Facebook exemplification (Delcea et al., 2014; Delcea, 2014) or Twitter ontologies for users' sentiment analysis (Delcea et al., 2014).

More Heidemann et al. (2012) is pointing out a survey of this global phenomenon, while Subrahmanyam et al. (2008) are making a bridge between online and offline social networks and are trying to see whether there is a connection among the activities young people are having on the online social networks and how this can be related to what is really happening outside these OSN, in the offline networks. As a result, the authors concluded that “emerging adults may use different online contexts to strengthen different aspects of their offline connections” (Subrahmanyam et al., 2008).

Some properties of the online social networks, such as: the power-law, small world, scale free, etc. are measured and analysed using data gathered from some of the most popular online social networks, such as Flickr, LiveJournal, Orkut and YouTube by Mislove et al. (2007). A large data set has been considered, consisting in over 11.3 million users and 328 million links. The results confirm the well-known properties of the online social networks, gathering 187 citations.

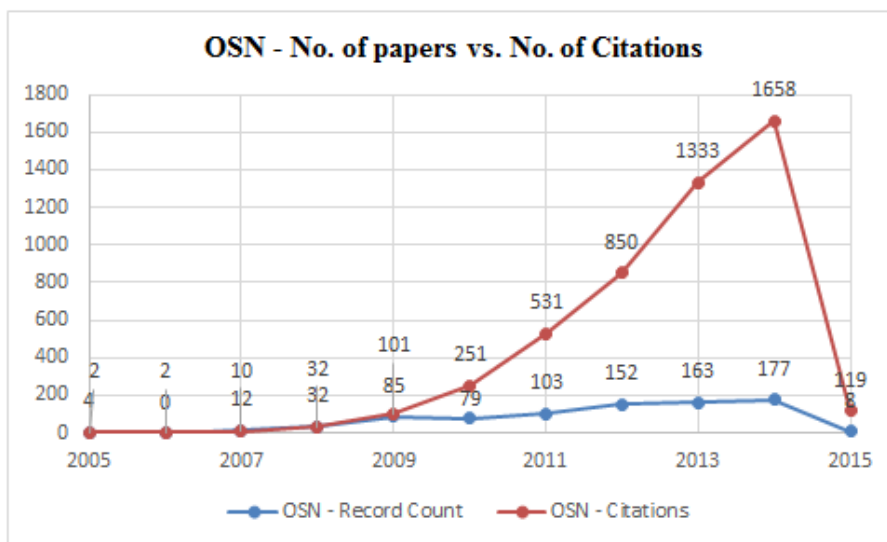


Fig 9. The no. of papers vs. their citations (WoS)

Figure 9 is summarizing the evolution of the number OSN papers and their citations. As it can be seen, both trends for papers and citations are increasingly from a year to another (in 2015 the analysis is just a partial one, due to the fact that the data were gathered only for the two months: January and February 2015).

5. Concluding Remarks

The present paper focus on a bibliometric analysis of the OSN field, as an integrant part of the social networks area. For this, the papers written in both the social networks and OSN are extracted from the Web of Science database and are presented and analysed in terms of total no. of papers published in each area, no. of citations, language of the papers, countries of provenience, types of documents (proceedings papers, journal articles, review, etc).

More than 70000 papers have been analysed form both the social networks and OSN area, underlying the fact that the social networks/OSN area is a continuous growing area, gathering year by year new researches/researchers from all around the world.

Even more, the citation metrics are strengthening this area's continuous growing due to their higher number from one year to another.

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