Identification of Research Thematic Approaches Based on Keywords Network Analysis in Colombian Social Sciences

José Hernando Ávila-Toscano, Ivón Catherine Romero-Pérez, Ailed Marenco-Escuderos and Eugenio Saavedra Guajardo

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Abstract

The purpose of this research was to unveil the structure of knowledge of Social Sciences in Colombia through the analysis of thematic networks and its association with different disciplines' new knowledge production to define scenarios and trends in each. 2992 published articles in the period 2006–2015 were revised in this research, all indexed in Web of Science, Scopus and other bibliographic databases, applying the social networks analysis technique to the keywords of all. The analysis included each discipline’s clustering coefficient and group metrics. The results described in this chapter identify how social disciplines in Colombia have mainly focused its research production in topics such as armed conflict, poverty and human development.

Keywords: social sciences, field of study, network analysis, keywords, Colombia

1. Introduction

Social Sciences agglomerate disciplines with a diverse object of study. Such diversity defines a thematic amplitude according to the multiple approaches and perspectives that surround social studies. Among the different disciplines, the appearance of distant methodological offers leads to significantly dissimilar analysis focuses regarding a same phenomenon. For
example, psychology applies quantitative research methods that belong to “hard sciences” through which it associates variables, predicts or explains human behavior. But also, psychology develops studies with qualitative approaches focused on the comprehension of the meaning around social and individual phenomena. Both of the approaches imply clearly differentiated theoretical corpora. Educational field’s research is predominantly qualitative [1], which also happens in Laws and Political sciences.

In summary, the study of Social Sciences is related to the variance of its object of study, which provides a complex, diverse and variable scenario of topics. For each scientific discipline, recognizing such topics means a significant contribution in the delimitation of the field of study, approaches posed or connections between investigative and theoretical proposals; it also helps researchers to determine which areas of work to explore or deepen and whom to cooperate with depending on the common interests.

2. The thematic-approach based analysis of scientific fields of study

Research in Social Sciences has lately changed its presentation, that is, with the publication formats used or association strategies between authors and institutions. Bibliometric research has mostly focused its interest on the productions indexed in Web of Science (WoS) and Scopus [2, 3], the internationalization of Social Sciences [4], the collaboration between authors and institutions [5–9] i.a. Bibliometric studies have made possible the characterization of the Social Sciences researchers’ scientific production, nevertheless, works surrounding thematic approaches analysis in this field of knowledge are still a proposal in development that has been evolving from the perspective of analysis and textual data visualization.

Studies with the goal to identify the structure of science are more common every day, seeking to understand areas of knowledge’s organization systems, relevant topics and research agenda. In other words, one of the most important tasks in scientometrics is the decomposition of scientific literature into disciplinary and sub-disciplinary structures [10]. This task is highly complex because it requires large volumes of information from which it is only possible to identify patterns through the use of computational tools [11].

The development of methods based on the usage of research production network metrics has been remarkably useful in the mapping construction. These studies have addressed diverse topics such as science interdisciplinary level [12], the multi-centric organization of basic sciences’ structure with bidirectional information flux in disciplines such as Physics, Chemistry or Medicine [13], the identification of edge and central concepts within a scientific discipline [14], the comparison of the different disciplines’ topological organization of quotation networks [15], the structural precision of the scientific panorama according to the size, similarities and interconnection among the different areas of science [16] i.a.

2.1. Social networks analysis and co-words method

Science maps or structures analyses also include the revision of scientific production’s semantic components as an identification mechanism of a particular area’s relevant topic of study.
For these purposes, the use of methods that take advantage of the textual resources and techniques of documentary summary has grown [15]. A useful tool that facilitates the identification of approaches and thematic trends in the different knowledge fields is the usage of metrics derived from text networks that define the interconnection of words or semantic fragments.

Social Network Analysis (SNA) is a common-used method in which the mapping procedures of terms’ network structure [17] are made considering the relative importance of the concepts, the relational density level between them, that is, real connections given within all the possible connections, and the proximity among the different semantic units considered inside the networks.

Another possibility lies in the identification of clusters, from which the aggrupation of words according to its attraction is conformed, which gives rise to textual regions of high or low frequency where words are common or rare respectively [18].

Based on these analyses, knowledge maps are generated, they are built from the identification of co-occurrence in terms or words. This is a content analysis technique that eases the analysis of relations emerging within the ideas from a specific text [19, 20]. In the analysis, main topics from a scientific area are extracted and co-related to determine bonds between them [21] allowing the construction of hierarchies to define central research problems and (smaller) auxiliary areas [22].

2.2. Thematic approaches and contextualization of social problems

An important premise given by the SNA is the dynamic nature of the networks, which means that they can be structurally transformed when influenced by diverse variables [23]. For this reason, knowledge maps or networks are understood as dynamic structures, which contents are adjusted to the evaluation period and the immediate reality that affects the scientific work.

This is an especially important consideration in Social Sciences, given that social’s relative nature is a feature inherent to the object of study of the disciplines that deal with these phenomena, therefore, the problems that social research addresses have a high contextual value [24, 25]. In general, the properties of scientific production are different between authors in the central region (North America & EU) and authors from peripheral scenarios as in the case of Latin-America [26, 27], this is noticeable in type of productions generated [28, 29] (central region has a higher number of works indexed in WoS and Scopus while peripheral area has preferences in local sources), as in the contents, themes of predilection and the significance value that the regional context gives to the studied problems.

This leads the social scientist to adjust the researched themes to the main problems of his immediate context [30, 27], which means that the networks of the thematic field can be substantially different depending on the social reality and the geographic position of the researchers. The study of meaning networks helps to understand those local-weighted differences defining the connections that facilitate the instauration of specific thematic axes in a field of knowledge.

This particular study applied the SNA fundamentals and the co-words method to identify the keyword networks in seven disciplines of the Social Sciences in Colombia. The results shared are part of a wider scientometric project that includes collaboration networks between authors and institutions and the assessment of research groups’ scientific quality.
3. Methodological aspects of the study

2992 scientific articles published between 2006 and 2015 were analyzed for this study, all indexed in WoS, Scopus and other regional and international bibliographic databases (PsycINFO, Scielo, REDALyC, Political Science Complete, ProQuest, and others). The works belonged to the areas of Psychology, Education, Law, Sociology, Political Sciences, Journalism and Other Social Sciences (Economics, Anthropology, i.a). The production was developed by 7774 researchers from 168 research groups classified in the Colombian National System of Science, Technology and Innovation (SCIENTI-Col).

The keyword networks analysis was accomplished through the construction of vertical edge matrices using the NodeXL Excel Template (2016 version) software. For the generation of sub-groups inside networks the cluster coefficient of each area of knowledge was used. The cluster coefficient is the measure in which the nodes of a graph tend to cluster together with a relatively high density of the links. In this study, the clusters were calculated using the Clauset-Newman-Moore algorithm [31], which is highly effective for inferring community structure from network topology, being much faster than other algorithms that precede it, as well as allowing the calculation of community structure analysis in very large networks. Subsequently the group metrics were calculated, being: word counting by semantic group, number of established connections, maximum geodetic distance (DGM), its respective statistic measure (GDμ), and the relational density of each group. As a general criterion, it was defined that the main groups chosen would have a minimum integration of 10 keywords.

The visualizations of the networks (graphs) were organized using grid algorithm, which allows to clearly identify the sub-groups and their interaction.

The graph distribution was made with Harel-Koren Fast Multiscale [32], which eases the esthetic drawing of non-directed graphs with edges ordered in straight line, accomplishing the drawing procedure quickly for big networks. The node sizes were assigned according to the gross nodal degree obtained, that is the number of mentions in each term, the visualizations show all the nodes sized above 5, the lesser-graded nodes were overshadowed from 25 to 40% for the purpose of esthetic, simplicity and better readability of the graphs.

4. Fields of study in Colombian social sciences. Relevant results

Table 1 describes the sociometric properties of each group identified in Other Social Sciences.

Being an area that integrates several disciplines, it is expectable for thematic groups to have diverse analysis lines. In group 1, for example, at least three sub-groups are differentiated; The first one is focused in science studies and scientific production, the second one emphasizes in the problems associated to violence and the third agglomerates social and anthropologic study proposals and methodological approaches.

Other lines are focused on experiences linked to the armed conflict and the necessity of the social capital recovery, as well as conflicts regarding the environment and the territories. Equally,
studies surrounding health, life quality and well-being of individuals in the civil reintegration process are highlighted. The scientific interest is also attracted by child labor, particularly referring to exploitation, violation of rights and exposure to risk conditions associated with work.

Groups 8 and 9 cross the eminent social barrier of the other groups, focusing on financial or administrative nature issues. Clustering terms related to the organizational activities and their financial affairs.

Figure 1 shows that thematic groups in Other Social Sciences have low density. The main inter-group relations are given between groups 1, 2 and 3, and between 2 and 4. Few thematic

Table 1. Keywords networks analysis in Other Social Sciences: description of metrics by thematic lines.

| Group | Group metrics | Grouped thematic lines (group name) |
|-------|---------------|--------------------------------------|
|       | Words | Connections | MGD | GDμ | Density |                                      |
| G1    | 55    | 179         | 4   | 2.245 | 0.080   | Science studies—social violence—diverse social approaches |
| G2    | 24    | 75          | 6   | 3.007 | 0.170   | Post-conflict and social recovery |
| G3    | 22    | 75          | 4   | 2.112 | 0.212   | Socio-environmental conflicts |
| G4    | 21    | 67          | 4   | 2.222 | 0.210   | Social reintegration and Life quality |
| G5    | 21    | 63          | 4   | 2.150 | 0.190   | Child labor and children development |
| G6    | 20    | 66          | 5   | 2.300 | 0.211   | Urban development, basic needs and Health |
| G7    | 11    | 37          | 2   | 1.455 | 0.400   | Bibliometric studies |
| G8    | 10    | 33          | 2   | 1.380 | 0.467   | Administrative and financial processes |
| G9    | 10    | 23          | 4   | 1.860 | 0.333   | Logistics |

a = Maximum Geodetic Distance.
b = Mean geodetic distance.

Figure 1. Graph of thematic groups with inter-group relations in Other Social Sciences.
interactions are found, perhaps because it is an area that includes research groups from different disciplines.

Information regarding thematic lines identified in *Psychology* appear in Table 2. In this discipline, the highest number of interconnected terms is related to neuroscientific issues and mental health, syndromes, conduct disorders and neuropsychological problems.

Several therapeutic approaches also excel inside relevant study topics, with cognitive system as precedence. Gender approach has an important role, specially facing phenomena as violence and sexuality. The qualitative notion of health and illness is seen from a perspective focused on the meanings constructed around the disease experience. The dynamic is also supported with other thematic lines directed to the meaning construction in front of social phenomena.

We observed interest in the social nature of psychological conditions of teens and children, by approaching violence, aggression and their related elements as factors that influence mental health and functional and non-functional behavior.

| Group | Group metrics | Grouped thematic lines (group name) |
|-------|---------------|-----------------------------------|
| G1    | 183 944 9 3.888 0.032 | Health and neuropsychological rehabilitation |
| G2    | 132 642 12 4.720 0.039 | Clinical psychology, psychotherapy and public health |
| G3    | 119 581 10 3.908 0.044 | Violence, aggression and mental health |
| G4    | 92 448 11 4.164 0.058 | Qualitative social research and consumer psychology |
| G5    | 86 336 7 3.096 0.051 | Quantitative methods; ethics and social/family conflicts |
| G6    | 82 330 9 4.166 0.055 | Family, attachment relationships and gender |
| G7    | 53 205 5 3.104 0.082 | Basic and applied psychology epistemology |
| G8    | 46 231 4 2.408 0.118 | Basic research and neurosciences |
| G9    | 41 113 8 3.367 0.090 | Instrumental studies in clinical psychology |
| G10   | 37 128 6 3.217 0.114 | Psychology and psychopharmacology |
| G11   | 36 148 5 2.924 0.140 | Health significances, illness and social development |
| G12   | 25 82 4 2.438 0.160 | Bibliometric studies |
| G13   | 22 74 6 2.711 0.173 | Subjectivities, violence and rights |
| G14   | 21 78 5 2.531 0.214 | Basic research in consumer psychology |
| G15   | 18 61 6 2.759 0.222 | Psychology of work and social inclusion |
| G16   | 15 38 5 2.347 0.238 | Positive approach in health and coping |
| G17   | 15 47 4 1.982 0.295 | Psychology of language |

a = Maximum Geodetic Distance.
b = Mean geodetic distance.

Table 2. Keywords networks analysis in Psychology: thematic lines metric description.
Among other thematic groups, psychology research in Colombia approaches: (a) consumer behavior, publicity and alike, (b) analysis of family’s cycle of life, affective relationships and family dynamics, highlighting a particular role in the analysis of the differences between men and women in issues related to family development, (c) axiological study of social problems through the integration of values, moral, reflexivity and relational, social, political conflict, (d) methodological studies (qualitative, quantitative), epistemological revisions and reflexive approaches about the discipline’s reach. Figure 2 shows keywords network for Psychology.

Colombian research produced in the area of Laws shares with the other described disciplines an interest towards armed conflict, human rights and diverse social and juridical issues associated with violence. Among the production of Law researchers also excel the topics related to international processes that involve human groups migration, States participation and the protection guarantees of the migrants. Another local context issues are clearly relevant such as armed conflict and transitional justice, illegal actors, disarmament processes and the relations with the victims. The approach of mediation stands out as an instrument associated with the construction of peace. In addition, terms inherent to law and juridical exercise ethics are also common (Table 3).

Inside the field of study around Laws in Colombia, the following topics have been objects of academic analysis: (a) protection relating to personal interests over real rights and properties, (b) historical sources revision, reflexive analysis of the juridical exercise, (c) ownership and tenure of land, crops and peasant labor, agro-industry and rural development from a perspective of agrarian law and social rights, (d) analysis of criminal law issues, from an accusatory perspective as well as a focus on the defendants and their protection guarantees, (e) the reality of women as a infringed individuals, integrating terms related to intimate, moral and sexual rights of women.

The graph (Figure 3) generated for this field of knowledge allows to identify a high connection level between keywords of each thematic group, moreover, there is a notorious relation between groups 2, 3, 5 and 6. For its part, group 1, which thematic is focused on conflict, migrations and
| Group | Words | Connections | MGD$^a$ | GDμ$^b$ | Density | Grouped thematic lines (group name) |
|-------|-------|-------------|---------|---------|---------|-----------------------------------|
| G1    | 179   | 933         | 7       | 3.341   | 0.033   | Armed conflict, international right, migration and minorities with gender approach |
| G2    | 132   | 731         | 7       | 3.580   | 0.041   | Constitutional and administrative law |
| G3    | 95    | 476         | 12      | 4.449   | 0.054   | Conflicts, mediation, peace and law ethics |
| G4    | 88    | 389         | 8       | 4.153   | 0.055   | Special protection groups and social rights |
| G5    | 82    | 567         | 9       | 4.093   | 0.081   | Civil and patrimonial right |
| G6    | 69    | 365         | 10      | 3.751   | 0.081   | Violence, refugee protection and environment |
| G7    | 69    | 483         | 7       | 3.302   | 0.097   | Public law and supranational issues |
| G8    | 57    | 288         | 11      | 4.596   | 0.095   | Epistemology, history and Right |
| G9    | 40    | 207         | 5       | 2.565   | 0.138   | Agricultural, environmental issues and countryside dev. |
| G10   | 29    | 195         | 4       | 2.257   | 0.239   | Law and criminal processes |
| G11   | 24    | 95          | 5       | 2.448   | 0.185   | Violence against women and rights approach |
| G12   | 17    | 88          | 4       | 2.021   | 0.324   | International law studies |
| G13   | 17    | 100         | 3       | 1.647   | 0.404   | Public administration and crime studies |
| G14   | 15    | 81          | 3       | 1.662   | 0.419   | Individual freedoms and role of the state |

$a$ = Maximum Geodetic Distance.

$b$ = Mean geodetic distance.

Table 3. Keywords networks analysis in Laws: thematic lines metric description.

Figure 3. Graph of thematic groups with inter-group relations in Laws.
gender, constitutes a sub-group that agglomerates a vast number of keywords with high-leveled nodal degree, what exposes this group as the area in the field of Laws in Colombia with the highest exploration level in the last decade.

In the case of Education (Table 4), 12 thematic lines were identified as relevant, with an important variety of contents due to the reach of the groups registered in the Colombian scientific system, focusing not only in pedagogical processes at a school level, but also in university teaching and the study of sciences.

Research in the education field in Colombia over the period 2006–2015 has shown a strong interest in technology and its application to the education of basic sciences, and also has emphasized in elements related to teaching/learning methods and the pedagogical reflection in sciences and at general level.

A relevant area consists in the analysis of the role of education, school and educational actors in front of a diversity of social issues that affect the individual and its community cores. The notion of human development is certainly appreciated as a transversal element in the educational field, also denoting an interdisciplinary perspective of education.

Investigation, teacher’s research formation, knowledge diffusion and its visibility are also themes approached by this discipline, accentuating the usage of technological tools in relation to the abilities and competences on its handle. In the second instance, there is interest regarding the disciplinary performance and the role of education as a mechanism of socio-political transformation (Table 4).

| Group | Group metrics | Grouped thematic lines (group name) |
|-------|---------------|-------------------------------------|
|       | Words | Connections | MGD\(^a\) | GD\(μ\)\(^b\) | Density |
| G1    | 99    | 335        | 9     | 3.750 | 0.045 | Tech. basic sciences and didactical fundamentals |
| G2    | 90    | 326        | 11    | 4.018 | 0.050 | Education in front of social issues |
| G3    | 34    | 106        | 7     | 3.126 | 0.112 | Educational research, scientific visibility and problem intervention |
| G4    | 32    | 104        | 5     | 2.938 | 0.125 | Disciplinary and informational skills |
| G5    | 31    | 95         | 6     | 2.968 | 0.131 | Education and politics |
| G6    | 24    | 75         | 4     | 2.219 | 0.167 | Ethics and education |
| G7    | 23    | 56         | 7     | 3.009 | 0.142 | Violence and education sociohistorical approach |
| G8    | 22    | 72         | 6     | 2.888 | 0.190 | Cognitive functioning and performance |
| G9    | 17    | 66         | 4     | 2.035 | 0.272 | Teaching and teaching practice |
| G10   | 16    | 51         | 4     | 2.000 | 0.267 | Science teaching and mathematics |
| G11   | 15    | 54         | 3     | 1.831 | 0.305 | Specific teaching performance |
| G12   | 15    | 65         | 3     | 1.938 | 0.305 | Childhood, care and protection |

\(a =\) Maximum Geodetic Distance.
\(b =\) Mean geodetic distance.

Table 4. Keywords networks analysis in Education: thematic lines metric description.
Other relevant contents in Education are: (a) Political vision assessment as a linked factor of educational teaching. The analysis of politics excels from the citizen participation and the state, and also the concept of subject as political subject, (b) ethical analysis focused on teaching, (c) analysis in Colombian history perspectives about violence, (d) the analysis of cognitive skills and individuals’ performance in the task execution, (e) especially in decisive strategies for problems or accomplishment of tasks in basic sciences specific areas of formation, (f) the teaching exercise and the role of the teacher. This includes theoretical points and pedagogical approaches of the educational activity, the teacher’s performance and skills from a perspective of academic specialization, directing the interest to professional performance areas, (g) welfare of the children, integrating the education with complementarian areas which focus was centered in the attention, care and prosperity of the minors.

Figure 4 graphically shows the suggested groups of keywords analysis for Education. It can be observed that groups 1, 2, 3 and 7 establish tight transitive connections. Highlighting group 1 (Technology, basic sciences and didactical fundamentals) as the most developed component in the educational area in terms of interconnected keywords and the number of connections with other thematic cores.

For the case of Sociology, the excelled thematic lines (Table 5) include topics in common with other disciplines, as violence, armed and social conflict, inequity, discrimination and social/economic gaps in specially protected populations such as women, natives and cultural minorities. Likewise, Colombian scientific production in sociology has focused on the investigative analysis of armed confrontation, sociopolitical issues and the nation’s reality in terms of violence. It is stressed a positive approach focused on peace, reconciliation and social change, highlighting
regional experiences and recovery surrounding violence (studies of case). Public policies have also been objects of study, as well as the development of social mobilization and settlement, population and territorial occupation activities, with its respective administrative, social and political implications. There is a notorious emphasis in forced displacement of population. Besides the aforementioned, there is a diversity of themes identified in the sociological study including (a) sociological aspects in education, formation and educative quality, pedagogical exercise, superior education and teaching of sciences, (b) environmental reality, role of the society in the care or degradation of the ecological systems, (c) experiments related to human health, as well as social discourses and practices in terms of environment, (d) revisions of natural and geographic elements of past archeological eras, including the study of plants or investigations about archeology or anthropology, (e) analyses of human activities from a contextual perspective with qualitative approach, (f) studies focused on the analysis of native communities’ health in general from an ethnographic perspective and native’s activities towards healthcare and protection, (g) analysis of relation between human groups and vegetal environment. The network analysis also allowed to identify that these groups themselves are constituted as sub-units (mostly independent from each other) in the universe of Sociology keywords (Figure 5). Among the analyzed groups, only group 1 (Sociopolitical conflict and transition to peace) has inter-group relations defined with groups 7 and 10, nevertheless, this connection is given by the usage of the word Colombia. Despite the thematic similarity between groups 7 and 10, there is no direct connection detected among their topics. Apparently in Sociology there are defined thematic fields which production or study area is usually sectorized and with low tendency to interact between approaches within the same discipline.

| Group | Group metrics | Grouped thematic lines (group name) |
|-------|---------------|-------------------------------------|
|       | Words | Connections | MGD$^a$ | GD$^b$ | Density |                   |
| G1    | 86    | 318         | 7       | 3.055 | 0.056 | Sociopolitical conflict and transition to peace |
| G2    | 37    | 157         | 7       | 3.002 | 0.143 | Public policies, migration and colonization |
| G3    | 33    | 126         | 6       | 2.621 | 0.140 | Cultural, gender and ethnic inequity |
| G4    | 22    | 86          | 5       | 2.566 | 0.212 | Educational sociology |
| G5    | 22    | 76          | 5       | 2.339 | 0.203 | Ecological/environmental sociology |
| G6    | 21    | 81          | 4       | 2.150 | 0.233 | Health and environment |
| G7    | 19    | 61          | 4       | 2.155 | 0.234 | Bio-geography, sociology and archaeologic-botany |
| G8    | 16    | 50          | 2       | 1.633 | 0.258 | Cultural socio-anthropology |
| G9    | 15    | 55          | 4       | 2.142 | 0.295 | Nativism, culture and health |
| G10   | 13    | 58          | 3       | 1.716 | 0.397 | Ethno-botany and sociology |

Table 5. Keywords network analysis in Sociology: thematic groups metric description.

a = Maximum Geodetic Distance.
b = Mean geodetic distance.

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The revision of Political Sciences is the last-but-one analysis, its thematic lines are varied (Table 6). The most important groups are related to Colombian sociopolitical conflict as the main emerging category, also integrating other types of organized violence and its social

| Group | Group metrics | Grouped thematic lines (group name) |
|-------|---------------|-------------------------------------|
|       | Words | Connections | MGD\(^a\) | GD\(^b\) | Density |
| G1    | 147   | 540        | 6        | 2.679   | 0.033   | Electoral studies, social violence and organized crime |
| G2    | 81    | 254        | 7        | 3.452   | 0.048   | Socio-economic development policies of nations |
| G3    | 76    | 263        | 8        | 3.704   | 0.058   | Foreign affairs, national security and politics |
| G4    | 72    | 304        | 7        | 3.403   | 0.070   | Political philosophy, transitional conflict and security |
| G5    | 63    | 208        | 9        | 4.204   | 0.068   | Administrative behavior and economic policies |
| G6    | 42    | 205        | 5        | 2.514   | 0.134   | Conflict-peace transition policies and national systems |
| G7    | 29    | 103        | 6        | 2.966   | 0.143   | Post-conflict and implied actors |
| G8    | 24    | 84         | 5        | 2.413   | 0.174   | Economic systems and military/security financing |
| G9    | 24    | 133        | 4        | 2.288   | 0.261   | Crime and role of public force |
| G10   | 22    | 95         | 4        | 2.107   | 0.234   | Productive sector responsibility in post-conflict |
| G11   | 14    | 43         | 4        | 1.939   | 0.275   | Collective participation in peacebuilding |
| G12   | 14    | 51         | 3        | 1.847   | 0.319   | Political behavior and participation |
| G13   | 11    | 45         | 3        | 1.504   | 0.455   | Urbane and environmental public policy |

\(^a\) Maximum Geodetic Distance.
\(^b\) Mean geodetic distance.

**Table 6.** Keywords network analysis in Political Sciences: thematic groups metric description.

The revision of Political Sciences is the last-but-one analysis, its thematic lines are varied (Table 6). The most important groups are related to Colombian sociopolitical conflict as the main emerging category, also integrating other types of organized violence and its social...
consequences. This field of study also focuses the scientific interest in phenomena associated to electoral activities and the exercise of democracy, including their own diverse issues such as partisan conflict, clientelism, electoral volatility, a.o.

In addition, it is noticed an ethical, axiological and psychosocial perspective of the armed conflict and the restoration of the rights of groups and individuals. This thematic field does not ignore the role of the victims or demobilized people from illegal armed groups, addressing affairs related to the recovery status of political subjects-of-rights in the post-conflict.

The political role in foreign relations is also a relevant topic, such as political, geographical and economical nature issues that constitute risks for the security of nations, assuming also the national risks based on the internal affairs in Colombia.

Other analytic field is the study of the economic development policies from the public administration including a regional perspective and proposals/reflections of economic development alternatives to the traditional model. Other highlighted topics are military expenses, security policies professionalization and the analysis of the economic development models and approaches. The study of crime is also noted, especially illegal organized activities related to the history of armed confrontation and war financing in Colombia. This group also weights the role of the police forces.

Armed conflict is without doubt the main topic in Social Sciences. Beside the described perspectives, other approaches direct the interest towards the private sector and institutions that contribute to the economy, in the development of productive processes that tend to contribute with social reintegration, as well as in the negotiations regarding the termination of armed conflict in Colombia and the participation of citizen groups in the peace-building.

Figure 6 shows the distribution of each thematic group with its interrelations. The graph allows to identify an important relation between groups 3 and 8, which emerging topics are indeed related (See Table 6), Likewise, group 1 shares bonds with almost all of the other groups, especially because the bonding concept is Colombia, being contextualized studies. This group also interacts...
closely with groups 3, 5 and 10, by referring a wide spectrum of themes related to conflict, State’s economic financing facing the ending of war, victims’ recovery and social reintegration.

Finally, Table 7 gathers data related to emerging thematic lines in the area of Journalism. The scientific interest in this area is for topics linked to the use of journalism and communications as a social impulse to highlight social minorities; political and sociocultural approaches are articulated to this line. Likewise, associated terms point an approach in the role of media and journalism in communication, information and entertainment, such approach gives relevance to the younger audiences and also emphasizes in the quality of the transmitted information. It is also observed a group of words directed towards formation in journalism.

Other important thematic field is the internet’s social networks and their usage with informative ends in front of relevant social/political events, as well as the analysis of the participative ends in the use of web networks and the definition of relations mediated by the technology.

Colombian research in journalism does not ignore the visible reality of this nation, thereof, issues as forced displacement, poverty and security (integrated to the use of communication media) excel as a study topic.

Investigations related to the following topics are also relevant: (a) the role of media (conventional & digital) in the coverage and diffusion of national/regional politic news, (b) television and radio productions and the development of journalism activity. Also headlining the interest in research processes focused in the content and discourses of journalism, and the gaps of information access in the knowledge society, (c) studies related to infancy and childhood, the protection of their rights and the diverse processes that surround their development, (d) the Internet and its properties, this time in relation to the history and how journalism communicates such information.

In journalism, other two thematic lines are accented apart from the interest in social issues, focusing their interest on artistic and esthetic affairs, in one hand, there is research in literary issues, based on the revision of representative authors and works in literature and

| Group | Words | Connections | MGD* | GDμ* | Density |
|-------|-------|-------------|------|------|---------|
| G1    | 54    | 184         | 7    | 3.018| 0.080   |
| G2    | 51    | 193         | 7    | 3.155| 0.095   |
| G3    | 36    | 122         | 6    | 2.617| 0.121   |
| G4    | 18    | 66          | 6    | 2.673| 0.248   |
| G5    | 13    | 43          | 4    | 2.178| 0.308   |
| G6    | 12    | 48          | 3    | 1.639| 0.394   |
| G7    | 12    | 48          | 3    | 1.639| 0.394   |
| G8    | 10    | 25          | 4    | 1.780| 0.333   |

* = Maximum Geodetic Distance.
μ = Mean geodetic distance.

Table 7. Keywords network analysis in Journalism: thematic groups metric description.
cinematography. On the other hand, there are social research and representations, as well as the use of images and cinema as object of study from journalism and communication.

Figure 7 represents each one of the main groups described and their interaction. The graph shows interaction between most of the thematic groups, although clearly groups 5, 6 and 8 establish subgroups apart from the other terms, which indicates that they are thematic areas less integrated to the traditional lines of journalism in the sample, nevertheless, they are large enough to constitute significant groups of topics. Groups 1, 2 and 3 are connected instead, which shows the closeness of the topics and interests that they share.

5. Conclusions

The analysis of thematic approaches in Social Sciences using the keywords of productions (article type) contribute with the detection of important conceptual lines, from which is constructed a semantic identification map capable of exposing thematic scenarios and the most common and relevant topics of analysis for different disciplines [19–22]. This is a scientometric exercise that leads to the disintegration of a scientific discipline into main areas and sub-areas of knowledge, which allows to understand the main interests in scientific research at a disciplinary level. Such results are useful because they orientate researchers around methodological paradigms, theoretical movements and focuses of interest for the scientific community, providing tools to decide what guidance to give to contributions, or even which areas to reinforce with their own productions.

The social disciplines studied present networks of thematic approaches in which fragmentation is common, having multiple subgroups of terms with moderate levels of relational density and few connections between emerged groups of terms.

This clearly is not a phenomenon exclusive for the social investigation in Colombia, but constitutes a common denominator in the Social Sciences for the breadth of its object of study and even the methodological and theoretical oppositions that occur, sometimes within the same discipline.
It has been described that in recent years, research in Social Sciences has become more international [4]. The increase of quantitative methods and the use of information technology have eased the communication and the comparison of research results with geographically distant colleagues [33]. Nevertheless, collaboration or international source quotations are not sufficient criteria to define the contents from an internationalist trend perspective. Term networks with wide thematic variety emerge in the different social disciplines in Colombia, although they clearly share common interests related to the immediate reality of the nation. They are thematic structures highly focused on the local nature issues and impact over the region, thereof topics as armed conflict between illegal forces and the Colombian State, along with the sequels associated to itself, the violation of women and children’s rights, the peacebuilding, and the challenges for human and social development constitute the main themes of all the studied disciplines.

Table 8 gathers the most frequent keywords of the field in general, that is, shared by different disciplines. As described previously [30, 27], the context has a dominant role over the topics and approaches postulated in the study of Social Sciences. The social scientist places among his objectives the knowledge development capable of translating or changing the experienced reality, thereof that the thematic cores identified in Colombian Social Sciences are closely related to the main social, political and economic issues experienced by the nation.

Considering the dynamic character of the knowledge networks, it can be inferred that future research lines focus on the associated processes to the construction of a post-conflict society, this in accordance with the construction of peace processes between the Colombian State and the illegal armed actors.

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| Disciplines          | Main topics                                                                 |
|----------------------|------------------------------------------------------------------------------|
| Other Social Sciences| Politic violence, Displacement, Human rights, Human development, Memory, Dispossession, Armed conflict |
| Psychology           | Risk factors, Child development, Violence against women, Domestic violence, Mental health |
| Laws                 | Discrimination, Human rights, Armed conflict, Political constitution, Conflict resolution, Civil society, Reintegration, Dignity, Homosexuality, Matrimonial property regimes |
| Education            | Pedagogical practice, Applied didactics, Risk behavior, Maternity, Poverty, Educational policy, Education for peace, Informational skills, Democracy, State |
| Sociology            | Conflict and region, Criminality, Social change and region, Victims, Public services, Residual gaps, Education quality |
| Political Sciences   | Organized crime, Paramilitarism, Forced displacement, Armed conflict, Social policy, International economic policy, State performance, Humanitarian exchange, Transitional justice |
| Journalism           | Minority language, Power, Displaced people, Social mobilization, New media, Online news, Messages, Poverty, Public space, Journalistic coverage, News sources, Infancy, Child abuse |
Conflicts of interest

The authors do not report conflicts of interest.

Nomenclature

| Acronym | Description                                      |
|---------|--------------------------------------------------|
| DGM     | maximum geodetic distance                        |
| GDμ     | geodetic distance mean                           |
| SCIENTI-Col | Colombian National System of Science, Technology and Innovation |
| SNA     | social networks analysis                         |

Author details

José Hernando Ávila-Toscano*, Ivón Catherine Romero-Pérez2, Ailed Marenco-Escuderos3 and Eugenio Saavedra Guajardo4

*Address all correspondence to: javila@unireformada.edu.co

1 Research and Innovation Management, Corporación Universitaria Reformada, Barranquilla, Colombia

2 Scientology, Mining and Data Analysis, Universidad Simón Bolívar, Barranquilla, Colombia

3 Faculty of Social Sciences, Arts and Humanities, Corporación Universitaria Reformada, Colombia

4 Universidad Católica del Maule, Talca, Chile

References

[1] Herrera-González J. La formación de docentes investigadores: el estatuto científico de la investigación pedagógica. Magis, Revista Internacional de Investigación en Educación. 2010;3:53-62

[2] Ho Y. Classic articles on social work field in social science citation index: A bibliometric analysis. Scientometrics. 2014;98:137-155. DOI: 10.1007/s11192-013-1014-8
[3] Ossenblok T, Engels T, Sivertsen G. The representation of the social sciences and humanities in the web of science. A comparison of publication patterns and incentive structures in Flanders and Norway (2005-9). Research Evaluation. 2012;21:280-290. DOI: 10.1093/reseval/rvs019

[4] Verleysen F, Engels TCE. Barycenter representation of book publishing internationalization in the social sciences and humanities. Journal of Informetrics. 2014;8:234-240. DOI: 10.1016/j.joi.2013.11.008

[5] Henriksen D. What factors are associated with increasing co-authorship in the social sciences? A case study of Danish economics and political science. Scientometrics. 2018;114:1395-1421. DOI: 10.1007/s11192-017-2635-0

[6] Shin J, Cummings W. Multilevel analysis of academic publishing across disciplines: Research preference, collaboration, and time on research. Scientometrics. 2010;85(2):581-594. DOI: 10.1007/s11192-010-0236-2

[7] Lancho-Barrantes B, Guerrero-Bote V, Moya-Anegon F. Citation increments between collaborating countries. Scientometrics. 2013;94:817-831. DOI: 10.1007/s11192-012-0797-3

[8] Low Y, Ng K, Kabir H, Koh M, Sinnasamy J. Trend and impact of international collaboration in clinical medicine papers published in Malaysia. Scientometrics. 2014;98:1521-1533. DOI: 10.1007/s11192-013-1121-6

[9] Prathap G. Second order indicators for evaluating international scientific collaboration. Scientometrics. 2013;95:563-570. DOI: 10.1007/s11192-012-0804-8

[10] Leydesdorff L, Rafols I. A global map of science based on the isi subject categories. Journal of the American Society for Information Science and Technology. 2009;60:348-362. DOI: 10.1002/asi.20967

[11] Silva F, Amancio D, Bardosova M, Costa L, Oliveira O. Using network science and text analytics to produce surveys in a scientific topic. Journal of Informetrics. 2016;10:487-502. DOI: 10.1016/j.joi.2016.03.008

[12] Porter A, Rafols I. Is science becoming more interdisciplinary? Measuring and mapping six research fields over time. Scientometrics. 2009;81:719-745. DOI: 10.1007/s11192-008-2197-2

[13] Rosvall M, Bergstrom C. Maps of random walks on complex networks reveal community structure. Proceedings of the National Academy of Sciences of the United States of America. 2008;105:1118-1123. DOI: 10.1073

[14] Silva F, Travencolo B, Viana M, Costa L. Identifying the borders of mathematical knowledge. Journal of Physics A: Mathematical and Theoretical. 2010;43:425-448. DOI: 10.1088/1751-8113/43/32/325202

[15] Silva F, Viana M, Travencolo B, Costa L. Investigating relationships within and between category networks in wikipedia. Journal of Informetrics. 2011;5:431-5.438. DOI: 10.1016/j.joi.2011.03.003
[16] Boyack K, Klavans R, Borner K. Mapping the backbone of science. Scientometrics. 2005;64:351-374

[17] Tonta Y, Darvish H. Diffusion of latent semantic analysis as a research tool: A social network analysis approach. Journal of Informetrics. 2010;4:166-174. DOI: 10.1016/j.joi.2009.11.003

[18] Carretero-Campos C, Bernaola-Galván P, Coronado A, Carpena P. Improving statistical keyword detection in short texts: Entropic and clustering approaches. Physica A: Statistical Mechanics and Its Applications. 2013;392:1481-1492. DOI: 10.1016/j.physa.2012.11.052

[19] Miguel S, Caprile L, Jorquera-Vidal I. Análisis de co-términos y de redes sociales para la generación de mapas temáticos. El profesional de la información. 2008;17:637-646. DOI: 10.3145/epi.2008.nov.06

[20] Verd J. El uso de la teoría de las redes sociales en la representación y análisis de textos. De las redes semánticas al análisis de redes textuales. Empiria, Revista de Metodología de las Ciencias Sociales. 2005;10:129-150

[21] Callon M, Courtid J, Ladle F. Co-word analysis as a tool for describing the network of interactions between basic and technological research: The case of poly-mer chemistry. Scientometrics. 1991;22:155-205

[22] He Q. Knowledge discovery through co-word analysis. Library Trends. 1999;48:133-159

[23] Trujillo H, Mañas F, González-Cabrera J. Evaluación de la potencia explicativa de los grafos de redes sociales clandestinas con UciNet y Net-Draw. Universitas Psychologica. 2010;9:67-78

[24] Larivière V, Sugimoto C, Cronin B. A bibliometric chronicling of library and information Science’s first hundred years. Journal of the American Society for Information Science and Technology. 2012;63:997-1016. DOI: 10.1002/asi.22645

[25] Nederhof A. Bibliometric monitoring of research performance in the social sciences and the humanities: A review. Scientometrics. 2006;66:81-100. DOI: 10.1007/s11192-006-0007-2

[26] Gingras Y, Mosbah-Natanson S. Where are social sciences produced? In: World Social Science Report. Knowledge Divides. Paris: International Social Science Council and UNESCO; 2010. pp. 149-153

[27] Mosbah-Natanson S, Gingras Y. The globalization of social sciences? Evidence from a quantitative analysis of 30 years of production, collaboration and citations in the social sciences (1980-2009). Current Sociology. 2014;62:626-646. DOI: 10.1177/0011392113498866

[28] Huang M, Lin C. A citation analysis of western journals cited in Taiwan’s library and information science and history research journals: From a research evaluation perspective. Journal of Academic Librarianship. 2011;37:34-45. DOI: 10.1016/j.acalib.2010.10.005

[29] Hu C, Hu J, Gao Y, Zhang Y. A journal co-citation analysis of library and information science in China. Scientometrics. 2011;86:657-670. DOI: 10.1007/s11192-010-0313-6
[30] Gantman E. La productividad científica argentina en Ciencias Sociales: Economía, Psicología, Sociología y Ciencia Política en el CONICET (2004-2008). Revista Española de Documentación Científica. 2011;34(3):408-425. DOI: 10.3989/redc.2011.3.829

[31] Clauset A, Newman MA, Moore C. Finding community structure in very large networks. Physical Review E. 2004;70:1-6

[32] Harel D, Koren YA. Fast multi-scale method for drawing large graphs. Journal of Graph Algorithms and Applications. 2002;6:179-202

[33] Borgman C. The digital future is now: A call to action for the humanities. DHQ: Digital Humanities Quarterly. 2009;3:1-21. DOI: 10.3989/redc.2011.3.829