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Scientific Mapping of Social Accounting using Research Indexed in Scientific Databases

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Abstract

Scientometrics is one of the most important scales for evaluating scientific outputs. Co-word and social network analysis (SNA) were used to investigate relationships in the field of social accounting researches indexed on Scopus. The findings of the study indicate that the most frequent topics and vocabulary in this area is economic analysis, economic and social effects. Moreover, the most valuable subject areas were identified: based on closeness, they are water resources, tourism economics and structural adjustment. Based on centrality, economic impact, economic analysis, environmental economics and income distribution. The results of the study indicate that many important social and environmental issues can be assessed through social accounting. Co-authorship analysis revealed that the co-authorship network in this domain was discrete and with low density. By utilizing the co-occurrence map, researchers and policymakers can make policy making more effective through being aware of the research trends and hot topics in social accounting.

Keywords: social accounting, scientific map, word co-occurrence, co-authoring, scientometrics, social network analysis

1. Introduction

According to the legitimacy theory, an organization should be held accountable by increasing the scope of disclosure of social and environmental information in its annual report [27]. Social accounting Includes operations and publications related to accounts of mutual, social, environmental, employee-related, community-related, customer-related actions and activities, along with activities related to other stakeholders, and, to the extent possible, the result of such actions and activities [41]. O'Dwyer (2005) states that social accounts are more similar to combining non-financial numbers and information and include non-numerical information, although

they might include financial information. O'Dwyer argues that since social accounting is not a perfectly logical and consistent environment or activity, it is difficult to define [41]. Social accounting focuses on value transactions between organizations and their stakeholders; both market ones, where the value perceived by the different stakeholders is identified, and non-markets ones, where transactions are monetized at their fair value [46].

In the 1990s, interest in social accounting reemerged, with significant concern in the public sector (government) and the private sector (business) with the global social impacts and the environment, such as human rights, ethics, conduct, and values and quality of life [47].

The past 25 years has been a period in which accounting has had a remarkable impact, be it positive or negative, on global, social and environmental issues. While many people argue that, over the past 25 years, there have been many positive initiatives around the world on social and environmental issues, the increasing number of displaced persons, social and occupational injustice, urban violence and lack of access to favorable public conditions on the social side on the one hand, and acceleration in the extinction of species, climate change, deforestation, desertification, pollution of water and land, and increase in the population in on the environmental side on the other hand indicate worrisome conditions more than ever before. The list of these undesirable conditions includes more than mentioned, becoming longer on a daily basis [14].

In the 1960s and 1970s, a group of accounting scholars systematically questioned the basic assumptions of traditional accounting as well as the notion that accounting is objective, unbiased and invaluable. Critical accountants, for example, believe that accounting generates a particular interpretation of social reality by enumerating specific items in the case of accounting situations and excluding others. This interpretation, consistent with specific assumptions about how society operates and how it should operate has implications for decision-making and policy-making [53]. As experience shows, to better assess the role and trends of each section of accounting science, it is necessary to reasonably diferentiate what is a promising direction from what is just a fashionable trend [49]. It is well known by researchers in the field of library and information science that both the classical Web of Science and the rising star Scopus are widely used in bibliometric related studies [57].

The social accounting implies addressing cost-benefit measures on environmental issues , in order to limit pollution and other negative effects on the environment (reduction in biodiversity), but also complementary measures to boost the main macroeconomic indicators through the business component (GDP, total investment, reducing inflation by limiting deviations from the consumer price [39]. The aim of social accounting is to be complementary to traditional accountancy [23]. Social accountability and environmental accounting covers issues that urgently require the attention specially during disturbing circumstances in society, social accounting possibly is pragmatic in order to accomplish consistent and effective change. Social accounting can inform society at large and provide new ways of seeing. social accounting may conducive in shifting management attitudes and practices which promote human rights [50]. Social accounting broadens the factors that are considered

in an accounting model and includes stakeholder engagement as a critical component. Integrated social accounting brings together social and environmental performance with financial performance [36]."social accounting is three things: (i) a fairly straightforward manifestation of corporate efforts to legitimate, explain and justify their activities; (ii) an ethically desirable component of any well-functioning democracy and, (iii) just possibly, one of the few available mechanisms to address sustainability that does not involve fascism and/or extinction of the species"[50].

Social accounting is more concerned with macroeconomics and includes a study of how industries and institutions relate to the wider economy and society, and how they produce goods and services, generate income, and distribute income together. Social accounting methods have been widely applied in developing third world economies, such as Iran, Malaysia, Sri Lanka, Pakistan, Indonesia, Ecuador and Swaziland [33].

In applying these techniques, social accounting models, or SAMs, can be tailored to fit the specific needs of countries and used as integrated databases to understand the effects of national economic policies. While the UK Treasury has used economic models for more than a quarter of a century, in most less developed countries SAMs are now built similar to the economic characteristics of different local economic conditions. Such models can be graphed, as shown in the literature, and increasingly used in shaping public economic policy [33].

Social accounting also relates to microeconomics, as a growing number of companies are active in social accounting, auditing and reporting. They publish social and environmental reports annually, providing detailed information on relationships with their stakeholders including investors, employees, consumers, suppliers, central and local governments, and environmental associations. Financial rating agencies evaluate firms not only for their economic and financial performance, but also for their social, environmental, and ethical performance [33].

Knowing the state of scientific production and advances in various subject areas, including social accounting, can help gain a complete picture of the type of scientific activities in the field and identify the strengths and weaknesses of the research. One of the most validated methods for evaluating scientific output today is the use of scientometrics, which is informally referred to as measuring science. It has emerged in the scientific community since the late 1960s [4].

Bibliometric methods are statistical analyses used to examine scientifc publications, and citation analysis constitutes a signifcant part of bibliometrics. A citation, in this paper, is understood as an entry in an article’s reference list. The foundation of citation analyses is the belief that a citation is a valid and reliable indicator of a publication’s infuence on, and contribution to, a discipline [3].

Given the increasing volume and substantial production of scientific information in various specialized fields, it is difficult to review all scientific literature produced by experts. Therefore, making use of international databases containing a significant portion of internationally valid information can be the fastest way to access information in any field of study [24]. Scopus was thus searched for all documents containing the subject of "social accounting" which have been published since the

advent of Scopus. Then, the results were analyzed using software programs such as VOSviewer, Gephi, Publish or Perish.

2. Statement of the problem

Social accounting makes possible the broadening of the range of information provided in an accounting statements to represent economic, social and environmental issues, thus enabling the participation of a large group of stakeholders in its compilation. This is a relatively new field, still more novel for nonprofit organizations [53].
The social accounting system has its own principles, rules, and concepts such that it can be seen as a completely separate discipline such as management accounting, government accounting, etc., which aims to social issues. Most of the papers in the field have created a new image of social and environmental accounting. The term 'new concepts' actually means the introduction of new (different) approaches to social and environmental issues by authors, and these new methods can work closely with accounting practices, which represent major changes in practice that can point to the desired range [21].

Social accounting is concerned with how social and environmental activities (which may or may not be worrisome) can be expressed by different elements of a community. Hence, the social accounting process is about responding to non-financial issues that may arise in the arena of a corporate's social responsibility. Analyzing such accounts, or lack thereof, raises the fundamental question whether social accountability can be largely related to economic issues; moreover, it poses the question of what the prioritization and relationship of social and environmental issues are [21].

Social accounting expands the items that are considered in an accounting framework beyond economic accounts, and typically involves a number of stakeholder groups in the process of implementation. It includes a number of approaches including “social responsibility accounting, social audits, corporate social reporting, employee and employment reporting, stakeholder dialogue reporting as well as environmental accounting and reporting” [37].

The key issues in the social and environmental accounting literature are accountability and, in particular, the expansion of the level of accountability of organizations so that their shareholders can at least make informed decisions in support of the organization [13].

Social accounting presents:

A) a snapshot of an organization;

B) an evaluation of the performance of all aspects of the organization's work in a financial period;

C) an integrated image of the organization's social product, staff welfare issues, customer care, environmental impacts in the Area and related issues;

D) the organization's balance sheet in terms of social impact assessment [51]. Due to the importance of the subject, we decided to conduct this research using scientometrics. Investigating the research published in the field, we sought to attain and present:

1. a deeper analysis of this area;
2. keywords and important subdivisions of this field;
3. a co-authorship map;
4- value offered to the stakeholders;

Considering the above with co-word analyses, both co-citation and co-authorship, which are types of co-occurrence analysis, we looked for a conceptual map of social accounting. Some scientometrics research using word co-occurrence, co-authorship and co-citation is listed in Table 1.

3. Literature review

With the advent and variety of scientometrics techniques, it has become possible for researchers to explore the intellectual structure of their favorite disciplines depending on the method used [30].

The word co-occurrence method was first proposed to depict the dynamics of science. In 1986, Callon et al. published a book entitled Drawing the Dynamics of Science and Technology, which is a seminal work in co-word analysis. Many researchers have used this method to explore conceptual networks in different scientific fields.

ID	Article title	authors	method	Year
1	Past themes and tracking research trends in entrepreneurship: A co-word, cites and usage count analysis	Ramírez, L.J.C., Sánchez-Cañizares, S.M., Fuentes-García, F.J.	co-word	2019
2	Mapping the Intellectual Structure of Social Entrepreneurship Research: A Citation/Co-citation Analysis	Hota, P.K., Subramanian, B., Narayanamurthy, G.	co-citation	2019
3	An evaluation method based on co-word clustering analysis – case study of internet + innovation and entrepreneurship economy	Ji, Y., Jiang, Y., He, L.	co-word	2018
4	Structure and evolution of innovation research in the last 60 years: review and future trends in the field of business through the citations and co-citations analysis	Rossetto, D.E., Bernardes, R.C., Borini, F.M., Gattaz, C.C.	co-citation	2018
5	Corporate social responsibility research in international business journals: An author co-citation analysis	Zhao, H., Zhang, F., Kwon, J.	co-citation	2018

6	Is social innovation about innovation? A bibliometric study identifying the main authors, citations and co-citations over 20 years	Silveira, F.F., Zilber, S.N.	co-citation	2017
7	Female entrepreneurship: A co-citation analysis	Ferreira, J.J.M., Fernandes, C.I., Peris-Ortiz, M., Ratten, V.	co-citation	2017
8	Diffusion of Innovations model helps interpret the comparative uptake of two methodological innovations: co-authorship network analysis and recommendations for the integration of novel methods in practice	Cadarette, S.M., Ban, J.K., Consiglio, G.P., (...), Marin, A., Tadrous, M.	co-authorship	2017
9	The focus and frontier of corporate social responsibility: A co-word analysis of articles in SSCI, 2001-2014	Qin, X., Wang, Z., Zhao, H., Kaspersen, L.B.	co-word	2016
10	Through the magnifying glass: an analysis of regional innovation models based on co-word and meta-synthesis methods	Naghizadeh, R., Elahi, S., Manteghi, M., Ghazinoory, S., Ranga, M.	co-word	2015
11	Co-authorship networks and research impact: A social capital perspective	Li, E.Y., Liao, C.H., Yen, H.R.	co-authorship	2013
12	Co-word analysis of domestic network virtual society research hotspots and evolution	Cui, P., Zhang, W.	co-word	2012
13	Innovation performance of university co-authorship network	Li, L., Gao, X.	co-authorship	2012
14	Enabling Policy Planning and Innovation Management through Patent Information and Co-Authorship Network Analyses: A Study of Tuberculosis in Brazil	Vasconcellos, A.G., Morel, C.M.	co-authorship	2012

Table1. international research in the field of scientometrics

Reviewing the literature reveals that there has been no independent research on the application of co-authorship and word co-occurrence methods in the field of social accounting. Therefore, this study aims to identify and map those areas of social accounting research using a co-word method with an analytical perspective and to determine the efficiency of this method in identifying and defining the scientific and research priorities of the field.

4. Research method

Scientometrics can be defined as "the quantitative study of science, communication in science, and scientific policy." What began as Eugene Garfield's idea of creating an index to improve information retrieval in the 1960s leading to the creation of the Science Citation Index (SCI) was soon recognized as a new tool in the empirical study of science [31].

Scientometrics is one of the most important scales for evaluating scientific products. Makias-Chapula argues that "scientometrics indices have become essential to the modern status quo (in line with the latest developments) of a particular subject for the scientific community." Scientometrics relates to and overlaps with bibliometrics and information science interests. The terms bibliometrics, scientometrics, and information science refer to the component parts of studying the dynamics of the disciplines as reflected in the production of their sources [35].

Understanding the impact of scientometrics on the development of academic disciplines is a complex issue, one of paramount importance. Its relevance is due to the recent trend to introduce numerical scales of scientific performance to evaluate research activities and facilitate comparisons at different levels, for example, between researchers, institutions, or the media. These comparisons usually take the form of ratings designed to "measure" the "quality" of universities, scientists, scientific articles, and journals on a single scale. This development also points to a methodological shift in scientometrics whose conceptual origins lie in an interpretive analysis of scientific communication aimed at understanding the characteristics of academic publication discourse [1].

Van Raan (1997) believes that scientometrics research is limited to quantitative studies of science and technology. It aims at advancing science and technology; it is also about social and political issues. He divides the main interests of scientometrics into four intertwined areas:

(1) developing methods and techniques for the design, manufacture and use of quantitative indicators in important aspects of science and technology;

(2) the development of information systems in science and technology;

(3) the study of the interaction between science and technology;

(4) an overview of cognitive and socio-organizational structures of scientific areas and development processes in relation to social factors [54, 35]. Researchers in social network analysis understand networks as sets of objects called "nodes" that are connected by one or more relationships called "links". In the social sciences context, nodes can be a wide range of social units such as individuals, groups, organizations, companies, governments, and countries [26].

The present applied research has been conducted using common methods in scientometrics with techniques such as word co-occurrence, co-citation, co-authorship and SNA. The research community consists of all articles indexed on the Scopus database since its advent on the subject of "social accounting". For this reason, the word "social accounting" is searched for in the titles, abstracts and keywords of articles written in English.

After retrieving records related to social accounting, in order to perform co-word analysis, 3970 keywords were obtained from 1338 records, of which, according to Bradford's law, those with frequency of 5 and above (that is, 301 words) were considered frequent.

Next, co-words were examined using expert opinions. Some words that had no special meaning in the structure of their respective sciences were omitted, such as "human beings", "education", "research methods", "developed countries", etc.

Next, keywords with a frequency of 5 and above were included in the final analysis. It should be noted that various studies using word co-occurrence analysis have used different thresholds to include top keywords in the final analysis; for example, Liu et al. restricted their analysis to 66 words, which accounted for about 55% of the total frequency [32], and Hu et al. (2013) limited their final analysis to 181 keywords, representing 29% of the total [25].

For word co-occurrence analysis, hierarchical clustering and multidimensional scaling are commonly used. Hierarchical clustering has the ability to identify clusters of each keyword and show the relationships between them. Therefore, each cluster was visited using "VOSviewer" software. The maps created using the multidimensional scale can also reveal important clusters and their position among other clusters based on the degree of correlation. Therefore, a multidimensional scale map was developed using Gephi.

Other features of the word co-occurrence matrix network, including centrality, density, weight, etc. were measured using Gephi software to find out more about the study area.

Also, for co-authorship analysis, out of 2062 unique authors in the area of social accounting research, it was determined that 65 authors had participated in at least 5 studies. It was further stated in the co-citation analysis that a total of 25474 citations were made in all articles.

5. Findings

The findings are presented in this section.

Reference date	2022-03-26 22:51:03 +0430
Publication years	1946-2021
Citation years	76 (1946-2022)
Papers	1338
Citations	25474

Citations/year	335.18 (acc1=521, acc2=277, acc5=101, acc10=34, acc20=8)
Citations/paper	19.04
Authors/paper	2.21/2.0/multi (mean/median/mode)
Age-weighed citation rate	1627.43 (sqrt=40.34), 963.71/author
Hirsch h-index	73 (a=4.78, m=0.96, 12639 cites=49.6% coverage)
Egghe g-index	124 (g/h=1.70, 15542 cites=61.0% coverage)
PoP hI,norm	54
PoP hI,annual	0.71

Table 2. Citation findings

According to Table 2, there are 1338 articles on social accounting that have been indexed in the Scopus database over the past 76 years, during which time 25474 citations were received, ie 19.04 times per article and 335.18 citations per year.

5.1. Research trend in the field of "social accounting"

The results show that the research and development of scientific products in the field of social accounting in Scopus has been very impressive since its advent, with the growth rate of scientific products more than 4.5 times in the last 10 years. The whole research indexed belongs to the timeframe from 1946 to 1989 (Fig. 1).

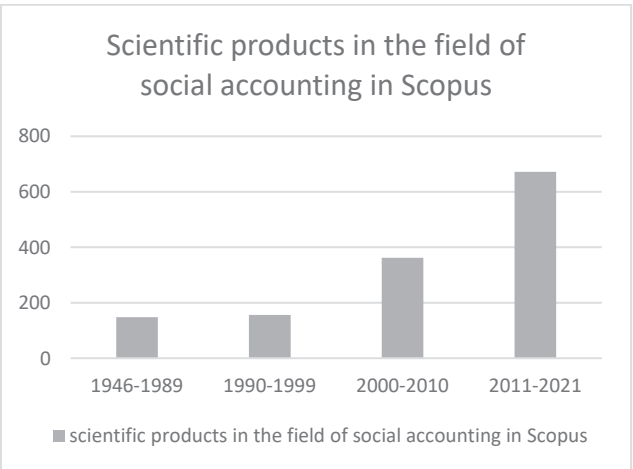

Figure 1. Number of publications from 1946 to 2021

One of the most important channels of information exchange in scientific disciplines is the scientific journals of each discipline. Therefore, identifying active and reputable journals in any field is of particular importance.

Analyzing data related to the contribution of each journal to the published articles indicates that Elsevier commands the largest number (31%), with 91 studies. This is visible in figure 2.

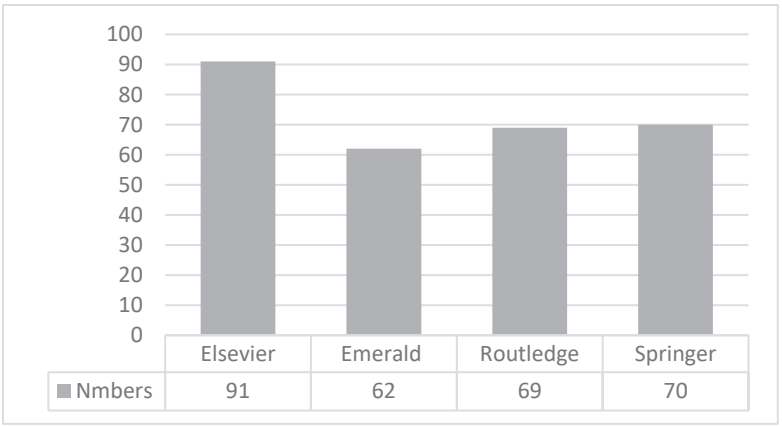

Figure 2. The percentage of published research per publisher

Figure 3 shows that over 80% of the studies were of papers.

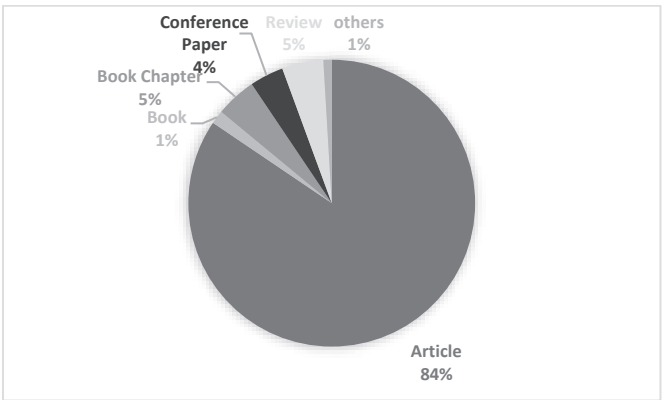

Figure 3. The percentage of submitted research

5.2. Base words in the field of social accounting

According to the table 3, economic analysis and economic impact are the most important base words in the field of social accounting.

Label	weighted indegree	weighted outdegree	Weighted Degree
economic impact	64	179	243
economic analysis	29	166	195

economic and social effects	29	142	171
environmental economics	77	85	162
income distribution	80	60	140
emission control	54	84	138
regional economy	97	27	124
economic development	23	88	111
economic growth	32	78	110
pollution tax	93	17	110
sustainable development	97	10	107

Table 3. Base words in the co-occurrence network analysis

The role of accounting in the occurrence (and recurrence) of corporate and business scandals and the associated crises of public confidence highlights the importance of clarifying our understanding of the relationship between accounting and the public interest and of addressing any deficiencies in that relationship [5].

Social accounting is a branch of accounting, which is the subject for social impact of the organization of economic activity to be measured and reported, applying the accounting basic principle and method [52].

The National Association of Accountants Committee of USA in 1974 identified the following four areas of social accounting:

(1) Community Development;
(2) Human Resources;
(3) physical resources and environmental role;
(4) the role of products or services.

The environmental role includes activities to reduce water, air and soil deterioration. [56]. Today, a wide range of stakeholders are interested in information related to social and environmental issues, so companies must publicly judge all aspects of their activities and should not restrict them to the just economic activities [12].

Through social accounting, a range of non-financial considerations may be integrated and prioritized in accounts that may be asked for and provided in the context of relationships of accountability between social actors (including, but not limited to, agency relationships) [6] Social accounting recognizes the effects and consequences of traditional accounting worldviews and practices, and can be applied at the level of entities, organizations, and other units of interest, including society as a whole [20]. Therefore, social accounting constitutes an element of social interaction that need not be limited to, or necessarily expressed in, financial terms [5].

5.3. Mapping co-occurrence

After modifying the network and removing from it irrelevant points such as countries, methodology related concepts etc., the final co-occurrence map was drawn. A map of the concepts of social accounting arising from the keywords of the research is plotted

with the keyword density using VOSviewer software (Fig. 4) and closeness degree using Gephi software (Fig. 5).

Figure 4. Co-occurrence network using key-word density

VOSviewer software assigns a density to each keyword based on its frequency, and according to co-word analysis, words with higher frequency receive higher densities. On the map, it can be seen that economic concepts such as economic analysis, economic impact, economic and social effects, and regional economy have the highest densities.

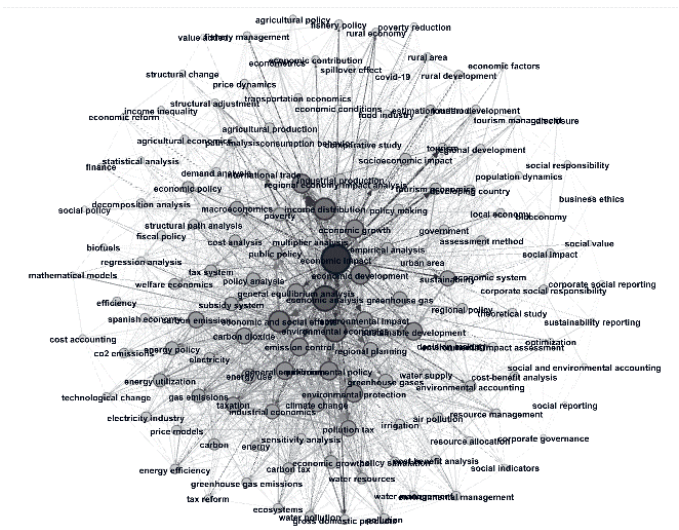

Figure 5. Co-occurrence network drawn with Gephi

The purpose of Gephi is also to study the correlation of node features and to build networks using visual patterns. Classification of social network metrics such as node degree or betweenness centrality can be used for better computation and visualization.

The longest path on the network, or network diameter was calculated to be 5. The average distance between two nodes was 1.921. The diameter of the network is measured by the distance of the longest paths in the network with the distance of the shortest paths (in terms of number of links or connections) between two nodes. The shorter the network diameter is, the faster the communication speed will be [9], and in the present network, each two word can be connected through 5 intermediaries.

5.4. Analysis of co-occurrence network

There are various indicators for word co-occurrence analysis which can be applied to scientific maps. For example, the network size is determined by the number of nodes, and the density of the network by the number of links. Centrality is one of the important indicators in network analysis. This index refers to the position of specific nodes within the network and its are closeness, betweenness, and degree centrality. Degree centrality is the simplest type of centrality. It refers to the value of each node obtained by counting the number of its neighbors. The number of neighbors is obtained based on the links connected to that node. In a word co-occurrence network, the more central the word is, the more communication and network it has and the more effective it is. Closeness is based on the concept of distance and path length. In a network, vertices that have the least distance to all other vertices have a higher closeness [15].

Drawing up scientific maps of social accounting concepts based on research conducted in this field is another result of this study. since science maps have a structure similar to social networks [22], we used social network analysis techniques to interpret scientific maps.

In the present study, closeness centrality refers to the words or points that are linked to other points with the least distance (least number of links). Betweenness centrality also indicates the importance of the node in terms of its location on the map and in terms of information transmission over the network.

analysis of the map shows that there are 144 nodes and 1907 links in this map. Since the number of links is more than nodes, the network is therefore continuous.

5.5. Centrality

Degree centrality index relates to the number of links that each node in a network is associated with. Therefore, degree centrality deals with the role of each node in the network. In networks with directed links, the in-degree is the number of relationships a node receives, while the out-degree is the number of relationships that each node sends out. The higher the node's in-degree (in particular, compared to the nodes with a high in-degree), the more powerful or important the node will be [48].

The centrality of the network nodes can be studied by using the three indices of degree, betweenness and closeness. Degree centrality for each node in the network is

equal to the sum of the nodes entered and the closeness is the average of the shortest paths between that node and the other nodes in the network. Betweenness of a node represents the number of times that the node is placed on the shortest path between the two nodes in the network [44].

5.5.1. Degree centrality

Degree centrality is one of the network metrics or indicators that is useful in analyzing the structure of entire networks and node positions in the network. It measures the number of links going in or out from a node in a network. degree centrality is the calculation of the number of links a node has with other nodes in the network. The subject with the most lines has the highest rank and is the central [7]. Degree centrality can facilitate or prevent the flow of resources between nodes in the network [16]. As shown in Figure 5, each two points or keywords are connected if they have at least one common co-occurrence in this network. The size of each node represents the degree centrality or the number of co-occurrence of that node with the other nodes in the network. Moreover, the more co-occurrent two nodes are, the greater the diameter of the link between the two nodes and the bolder the lines. In the present network, the keyword "economic impact" has the highest degree of centrality, which means that it has the highest degree of connection with other nodes (Table 4).

Label	indegree	outdegree	Degree
economic impact	28	76	104
economic analysis	17	70	87
environmental economics	34	41	75
income distribution	37	36	73
economic and social effects	17	54	71
economic development	12	52	64
regional economy	47	14	61
economic growth	14	44	58
emission control	18	39	57

Table 4. Words with the highest centrality degree

5.5.2. Degree centrality

Betweenness centrality of a node as a node's compatibility attribute indicates the importance of the node in terms of its location on the map and in terms of the distribution information on the network. The betweenness centrality is calculated based on the position of people in the network. The node with the highest betweenness centrality is in the middle of a large number of other nodes and passes through other nodes. These nodes have the power to isolate and enhance communication [40].

Analysis of betweenness centrality shows that most of the keywords have a betweenness centrality below 200 and 7 nodes are above 200.

Based on the analysis of the map and on the betweenness centrality, keywords economic impact, income distribution, economic analysis and environmental economics are the most important issues in the transmission of information in the network, that is to say, topics analyzed by interdisciplinary approach in the field of social accounting.

The following table (Table 5) shows the keywords with the highest betweenness centrality:

Label	Betweeness centrality
economic impact	671.604
income distribution	566.571
economic analysis	408.042
environmental economics	337.447
regional economy	290.270
sustainability	243.360
economic and social effects	203.486
Policy analysis	191.033
General equilibrium	155.825
Economic development	150.052

Table 5. Words with highest betweenness centrality

5.5.3. Closeness centrality

How fast an entity on the network can access more entities on that network refers to closeness. An entity with high closeness generally has the following characteristics:

- it has instant access to other entities on the network;
- it has a short path to other entities; it is close to other entities; and
- there is a high visibility about what is happening on the network [55].

The closeness centrality measure is calculated based on geodesic distance. It measures the distance of a node from the other nodes. This index represents the acceptability index [18].

According to the closeness diagram, most nodes are close to one another, having a closeness between 0 and 1, which allows the information to spread very quickly in this network. According to the calculations and the shape of word co-occurrence, issues like water resources, Tourism economics, and structural adjustment have the most impact, i.e., the highest closeness centrality. In fact, such nodes are less distant than all other nodes and are, on average, closer to all nodes. Thus, these nodes are more robust in the network [11, 42]. The following table (Table 6) shows the keywords with the highest closeness centrality:

Label	Closeness centrality
Water resources	1
Tourism economics	1
Structural adjustment	1
Tourism development	1
Social policy	1
Taxation	1
Theoretical stusy	1
Economic impact	0.8015
Sustainable development	0.7692
Water management	0.75
Economic analysis	0.7254
Income distribution	0.7023

Table 6. Words with the highest closeness centrality

The table above shows that environmental issues and resources in the co-occurrence network are of the highest importance based on closeness.

6. Network density

Density is used to check the degree of network cohesion. Network density can be defined as a set of relationships that connect nodes to each other and prevent the network from breaking [17]. Regarding network cohesion, it can be stated that if the connection between nodes is weak or the number of lines between the nodes are low, the network has a low cohesion and there will be many holes in the network. In this case, the network is discrete and the information flow will be very slow. Conversely, when there is a high number of links between the subgroups and there are few holes in the network, it is a continuous network [17, 29]. The co-occurrence network of the present study shows that the network has relatively low coherence due to its density of 0.093. This density indicates that only 9.3% of the potential internal communications in the network is operational. In other words, the number of links in the network can be relatively low, resulting slow information flow. The network density also determines the ratio of the number of relationships available to the number of possible relationships in the network. The density map of the co-occurrence network (Fig. 4) shows that the highest density is formed around the concepts of economic impact and economic analysis, and the words farther away from these two terms have less importance, less occurrence, and a lower number of neighboring nodes.

7. Hub

Network elements can be categorized into different classes through their participation in the network. For example, they may be classified according to the way they interact with other components of the system. One of the important distinctions that can be made based on their effect is the potential effect they have on the overall system and their capacity to transmit or process information. High-impact nodes are often referred to as hubs. Identification of hubs is needed to map the different areas that are most interoperable and contribute to system integration. One issue to note is the nodes which have high communication have a greater sharing factor. The high degree of centrality and their relevance as well as their high degree of interconnectedness in structural communication indicate that they play a vital role in the integration of processes and information flow [19]. Nodes that act as hubs and interconnect many nodes are mentioned in the following table (Table 7): economic impact, economic analysis, and economic and social impact are the largest network hubs.

Label	Hub
economic impact	0302997
economic analysis	0.274909
economic and social effects	0.241773
economic development	0.205063
Environmental economics	0.197799
emission control	0.1946
economic growth	0.191417
climate change	0.178785
environmental policy	0.149609
Income distribution	0.129665

Table 7. Main network hubs

8. Cluster analysis

Clustering means categorizing members of a set without supervision. In this way, clusters or classes are not predetermined and, in other words, cluster labels are not available. Clustering refers to finding a structure within a set of unlabeled data; in fact, cluster is a collection of data that are similar to one another [28]. Classification and clustering are different. In a classification task, you assign a class to a predefined label; but in a clustering task, there is no information about the classes in the data, and in other words, the cluster is extracted from data [43]. Consequently, after performing a clustering task, an expert should interpret the resulting clusters and, in some cases, some of the parameters that are included in the cluster but are irrelevant or of little importance are set aside, and clustering is performed again [10].

Cluster analysis was performed using Gephi. five different thematic clusters were identified and then clustered using expert opinion. The "socioeconomic impact" cluster is the largest cluster with 37 points and contains the social and economic impact related. Thus, in the present study, it is named the socioeconomic impact cluster. Among its points are economic impact and welfare economics.

The clustering results in Table 8 show the number of clusters, their naming, and the percentage of concepts present in each cluster. The clustering shows the automatic structure of the concepts, and the concepts within each group are most similar to each other. All 6 clusters have minimum intra-group differences and maximum inter-group differences. In the economic analysis cluster, for example, the concepts of sustainable development, economic and social effects, social indicators, cost accounting and such are most closely related to the concept of economic analysis.

Network characteristics				
Number of links		**clustering coefficient**	**Number of midpoints**	**Distance of nodes**
1907		0.51	144	2.01
Number of clusters	**Name of cluster**	**Number of nodes in**	**relation to total network (%)**	
0	**Economic analysis**	23	15.97%	
1	**economic impact**	38	26.39%	
2	**Environmental impact**	47	32.64%	
3	**Economic development**	32	22.22%	
4	**statistical analysis**	4	2.78%	

Table 8. Network characteristics

The clustering coefficient indicates how much the keywords tend to create co-occurring clusters. The clustering coefficient is always a number between zero and one [34]. In the table 8, the mean clustering coefficient of 0.51 is obtained which estimates the tendency of network nodes to communicate with each other and to form clusters at a low level. Also, the average distance of the network nodes is 2.01, which indicates the closeness of the nodes and the density of the network.

9. Authors and Co-authorship

The results show that there are 2062 unique authors in the social accounting field who have written all of the social accounting research available on the Scopus database.

The minimum number of studies for each author is 5, and 65 authors have the highest number of studies performed.

The co-authorship network density in the area of social accounting was 0.012. The network density is the number of edges available in the network to the number of all possible edges. Density as the number of relationships between elements in a network which hold the highest share among possible relationships in the network is always a number between zero and one. The higher the density of a network, the more the nodes are connected and are closer to each other [38]. Overall, the figure 6 indicates that the co-authorship network is discrete and has a low density.

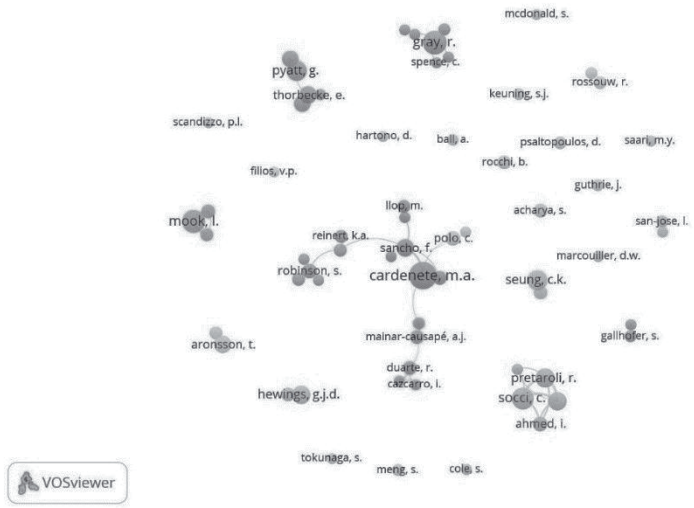

Figure 6. Co-authorship network based on degree centrality

There were 456 one-author studies, 394 two-author studies, 327 three-author studies, and the rest with higher author numbers. Careful scrutiny of the number of authors per article indicates that the dominant authoring paradigm in social accounting research is the collective authoring paradigm, and only about 34% of the articles have used the single author model, confirming that scientific and research papers and reports are the result of teamwork [2] and that the academic work, too, is increasingly the result of teamwork [45].

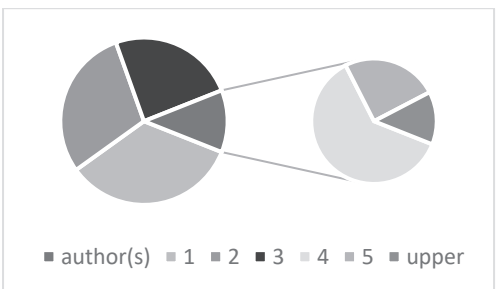

Figure 7. Multi-author research patterns

By looking at Figures 6 and 7, influential writers, writers' relationships with each other, and important clusters can be separated. There are 29 communities and clusters of co-authorship, and the main cluster is cluster 1 with 6 authors, with 20% of the links in this cluster being related to authors such as Adelman, I., Dorosh, P., Reinert, K.A., Robinson, S., Roland-Holst, D.W. and Tarp, F. These authors are the central and influential writers in this network. The authors' names are widely dispersed by the number of documents. On the scientific map, authors such as Cardenete and Gray account for the largest share of productions in the field of social accounting, as illustrated in Table 9.

Author	Productions
Cardenete	36
gray	23
mook	21
Pyatt	16
Hewings	14
Thorbecke	13

Table 9. Prolific authors in social accounting

C. Deegan was also cited as the author of the most cited paper, “Introduction: The legitimizing effect of social and environmental disclosures: a theoretical foundation”, which was published in 2002. it received 1516 citations. In table 10 most cited papers are gathered.

Cites	Authors	Title
1011	C. Deegan	Introduction: The legitimizing effect of social and environmental disclosures â€“ a theoretical foundation
528	R. Gray	The social accounting project and Accounting Organizations and Society. Privileging engagement, imaginings, new accountings and pragmatism over critique?
437	J. Bebbington, C. Larrinaga, J.M. Moneva	Corporate social reporting and reputation risk management
422	L.D. Parker	Social and environmental accountability research: A view from the commentary box
387	L. Moir	What do we mean by corporate social responsibility?
344	R. Gray	Social, environmental and sustainability reporting and organizational value creation?: Whose value? Whose creation?

311	R. Gray, C. Dey, D. Owen, R. Evans, S. Zadek	Struggling with the praxis of social accounting: Stakeholders, accountability, audits and procedures
302	B. O'Dwyer	Managerial perceptions of corporate social disclosure: An Irish story
267	A.M. Quazi, D. O'Brien	An empirical test of a cross-national model of corporate social responsibility
265	T. Shearer	Ethics and accountability: From the for-itself to the for-the-other
264	D. Owen	Chronicles of wasted time?: A personal reflection on the current state of, and future prospects for, social and environmental accounting research

Table 10. most cited paper

10. Discussion and conclusion

In this study, using co-occurrence analysis and scientific mapping based on articles on social accounting indexed in the Scopus database, we tried to identify the conceptual structure of this domain using co-word and co-occurrence analysis.

The results show that studies in the field of social accounting have grown significantly in the last decade and the assessment of social impacts has become more important than what it was in the past. The results also show the importance of concepts such as economic impact and analysis, and social and environmental issues.

The scope of the studies was analyzed using hierarchical clustering techniques and 5 clusters were identified in the study period. The second largest cluster with 38 keywords that affect both economic and social issues was found to emphasize that social goals do not reduce the importance of profit motivation.

Keywords such as economic impact, income distribution, economic analysis, environmental economics, as nodes with high betweenness in the network are crucial nodes, facilitating the formation and communication of information in the social accounting field and other areas, topics such as water resources, tourism economics, and structural adjustment have the most impact and the most closeness centrality and are able to access the rest of the network faster.

The co-occurrence network in the study shows that the network has a relatively low coherence, its density being 0.093 and with only 9.3% of the potential internal communications in the network realized.

Keywords economic impact, economic analysis and economic and social effects are the key hubs of the co-occurrence network that are highly interconnected with other nodes and facilitate communication among other nodes.

A careful examination of the number of authors for each article indicates that the dominant authoring paradigm in social accounting research is the collective authoring model, and scholars such as Cardenete and Gray are among the most active in this field, and, Adelman, I., Dorosh, P., Reinert, K.A., Robinson, S., Roland-Holst, D.W. and Tarp, F. constitute the largest social accounting research community. C. Deegan

was the author of the most cited paper, “Introduction: The legitimizing effect of social and environmental disclosures: a theoretical foundation”, which was published in 2002 and received 1516 citations.

The findings also showed that the Elsevier publishing company has published the largest number of articles in this field. Investigations such as word co-occurrence analysis are capable of answering questions of this kind: What is the focus of researchers in a scientific community? What are the different scientific fields and subfields? What evolution have they gone through? What topics will probably be in the forefront of scientists' attention in the near future? The results of this study show that social accounting is closely related to important socioeconomic categories and related analyses. Even though most accounting scholars do not currently promote their research to the general public and policy makers, these kind researches suggest that such efforts can have promising results [8].

Although social network analysis research itself does not provide suggestions, it can be helpful in understanding the current situation and guide scientific trends in social accounting. The results of the present study help researchers in social areas, especially social accounting, to explain the study and policy-making process in this area based on the identified effective areas.

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