The Profile of Scientific Publications on Cooperatives and Accounting: In Light of Unsupervised Classification

ABSTRACT

Objective: The general objective of this study was to analyze the profile of scientific publications on Cooperatives regarding to Accounting, extracted from (i) scientific journals, with titles in Accounting, from the *Sucupira* Platform; and (ii) Google Scholar, in light of the Unsupervised Classification.

Method: As a methodology, initially a systematic research was carried out, about cooperatives and accounting themes, in scientific journals, qualified by the Coordination for the Improvement of Higher Education Personnel (CAPES), with the indicative strata of quality - A1, A2, B1, B2, B3, B4, B5, and C. It covered the period from 2010 to 2019, which resulted in a sample of 103 documents. Therefore, the cluster analysis technique was applied.

Originality/Relevance: There is still no study that analyzed the profile of scientific publications in cooperatives in relation to accounting in light of unsupervised classification; nor is there any study that mentioned the specificity of accounting that contributed the most in the context of cooperatives.

Results: The results point to a significant presence of documents with an A2 quality indicator of the *Sucupira* Platform in the profile. Among the seven groups analyzed, the results indicate that only 30% of the main similar subjects deal with Financial Accounting, revealing that Management Accounting has a strong bias towards the economic and sustainable growth of cooperatives in the country.

Theoretical/Methodological contributions: The main contributions and impacts of this study are related to the extension of the literature with bibliometric and scientometric studies on cooperatives and accounting; expanding the precepts of unsupervised classification in accounting-related research.

Keywords: Cooperatives. Accounting. Unsupervised classification.

Iolanda Albuquerque Queiroz Oliveira
Universidade Estadual da Paraíba, PB, Brasil
iolandaaq2013@gmail.com

Ana Maria da Paixão Duarte
Universidade Estadual da Paraíba, PB, Brasil
anamariapaixao@uol.com.br

Ádria Tayllo Alves Oliveira
Universidade Estadual da Paraíba, PB, Brasil
adriatayllo@servidor.uepb.edu.br

Kleber Napoleão Nunes de Oliveira Barros
Universidade Federal Rural de Pernambuco, PE, Brasil
Knnob9@gmail.com

1 INTRODUCTION

Cooperative movement in Brazil emerged in 1889, with the first consumer cooperative named *Cooperativa de Consumo dos Empregados da Companhia Paulista*, in São Paulo. In 1902, the first credit cooperative was created, named *Sicredi Pioneira RS*, in Rio Grande do Sul (Veiga & Fonseca, 2001), and thus other cooperatives emerged among the activities of industry, commerce and service provision, in the following branches: agriculture, livestock, credit, transport, work, production of goods and services, health, consumption and infrastructure (OCB, 2021a).

The emergence of these cooperatives was influenced by basic principles redefined by the International Cooperative Alliance (ICA), such as voluntary and free membership, democratic control by members, economic participation of members, autonomy and independence, education, training and information, cooperation between cooperatives, and concern for the community (Crúzio, 2001).

Based on these principles, cooperatives have played an important role in society by developing sustainable actions that contribute to the development and promotion of the regions where they operate, through the generation of work, employment and income, and the consequent growth of the local economy (Ilha, Leismann, & Rippel, 2011).

Over these years, an increasing trend in the number of cooperatives created in the country is observed. According to the Organization of Brazilian Cooperatives (OCB) system, these numbers grew from 6,652 cooperatives in 2010 to 6,828 in 2018. This increase has transformed the reality of thousands of Brazilians through the generation of work, employment and income. During the period from 2010 to 2018, not only the number of cooperatives grew, but also the number of people who joined the cooperatives, which grew by 62%. As a result, the number of jobs generated by these organizations increased by 43% (OCB, 2021b).

Clearly, there is the exponential growth of cooperatives and the consequent strengthening in the local and global economic market. Therefore, like other organizations, such as limited liability companies and joint stock companies, cooperatives also develop organizational performance strategies to consolidate their business activities in the economic and social environment (Munaretto & Corrêa, 2016).

However, this exponential growth is not only consolidated by its actions or organizational performance strategies. Allied to their actions or strategies, information is necessary for the management and control of the assets of these cooperatives for decision making, in order to resolve organizational issues. In this context, the information generated by accounting is inserted. According to Sell (2004, p. 15), "organizational information passes through accounting, which should, in a detailed way, promote evidence and information that managers need".

In this perspective, accounting as a social science, persuaded by social, political and economic changes, is no longer just a tool that provides knowledge, with regard to meeting legal requirements, but also assumes the function of joining management, in the face of transforming data into useful information for managing organizational activities (Juliano, 2012).

In the context of accounting, the role of its main specificities stands out: Financial Accounting and Management Accounting. According to Salotti, Lima, Murcia, Malacrida and Pimentel (2019, p. 6 - 7), "Financial Accounting aims to provide information to external users in general", while "Management Accounting involves the development and interpretation of accounting information for the specific purposes of managing the operating and financial activities of companies".

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In this sense, considering the economic and social potential that cooperatives have in the local and global scenario, combined with the information generated by accounting in the context of these organizations, it is justified to investigate how accounting has been useful or how it has contributed to economic and sustainable growth of cooperatives.

Several studies have been developed on the contribution of cooperatives to sustainable economic development, such as: the Colombian solidarity economy in the context of globalization (Rodríguez, 2017); the dimensions of sustainable development (Almada, Santos, Cabral, & Pessoa, 2014); self-management in the solidarity economy in Brazil as a response to unemployment (Singer & Souza, 2000), among others. Likewise, accounting studies related to cooperatives were carried out, such as: network recycling chain management (Silva, Fuggi, & Marini, 2015); main governance aspects that generate agency conflicts in agricultural and rural credit of cooperatives in Brazil (Bialoskorski Neto, Barroso, & Rezende, 2012); provision of accounting services by accountants in the cooperative environment (Anjos, Miranda, & Silva, 2011), among others.

However, there is no study analyzing the profile of scientific publications in cooperatives regarding to accounting in the light of unsupervised classification, with a systematic research in the literature. There are also no studies mentioning the specificity of accounting that contributed the most in the context of cooperatives, and that has directly influenced their growing number and their progress in the country. Such facts, therefore, characterize the originality of this study.

For these reasons, the research question for the present study arose: what is the profile of scientific publications on cooperative and accounting topics, from the scientific journals of *Sucupira* Platform and Google Scholar, in light of the unsupervised classification?

Thus, the general objective of this study was to analyze the profile of scientific publications on cooperative and accounting topics in the light of the unsupervised classification, considering the period from 2010 to 2019, extracted from scientific journals with titles in accounting on the *Sucupira* Platform and Google Scholar databases. In order to achieve this objective, the specific objectives were developed: to present a brief description of the history and regulations of cooperatives; to present knowledge about accounting history; and to approach previous studies related to cooperatives and accounting, which served as a conceptual basis for the present study.

Therefore, the main contributions and impacts of this study are related to the extension of the literature with bibliometric and scientometric studies on scientific publications on cooperatives and accounting topics, considering the period from 2010 to 2019, highlighting the importance of accounting in the context of cooperatives. Furthermore, this study aims to broaden the precepts of unsupervised classification in accounting-related research.

The study is organized into four sections, in addition to this introductory section. In the second section, the literature review is presented; in the third section, the research methodology is defined; in the fourth section, the analysis and interpretation of the results are carried out; and, in the fifth section, final considerations, limitations and suggestions for future research are presented.

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2 LITERATURE REVIEW

2.1 Historical and normative evolution of cooperatives

With regard to cooperative movement, everything starts in the city of Rochdale-Manchester, in the countryside of England, where a group of workers, in order to survive, got together to set up a warehouse and buy food to be distributed equally at lower prices among them. Thus, cooperative was designed in 1844, under the liberal economy regime, with the Rochdale Society of Equitable Pioneers, whose basic principles were honesty, solidarity, equity and transparency. The union of this group would later be named cooperative (OCB, 2021c).

The cooperative system emerged as a strategy to face the inequalities generated by open competition, as well as the exploitation of labor. Cooperative movement is seen as a way to achieve social justice, based on the participatory and democratic management model. The term cooperative movement comes from the word cooperate, which according to Pereira (2003, p. 226) "denotes uniting and disposing of the means and efforts of each individual to carry out a common activity, being willing to achieve a mutual result".

Studies show that throughout human civilization there was cooperation associated with struggles for survival, economic, political, social crises, and environmental changes. Cooperative system is intrinsic to work and not to profit; and it is based on mutual help, considering values and aspirations, and it does not consider accumulated individual capital (Coutinho, Beiras, Picinin, & Luckmann, 2005; Frantz, 2001; Scopinho, 2007; Pedrozo, 1993).

Bialoskorski Neto (1997) points out, from an economic point of view, that cooperative societies do not have an independent existence, as in capital companies. They are created by a group of individuals with common and permanent interests, with the main objective of carrying out economic activities that are necessary for economic progress, as well as for the well-being of the associates (Pedrozo, 1993).

In Brazil, when cooperation is established in accordance with regulations, it gives rise to cooperative societies, which are regulated by Law nº 5764, December 16, 1971. This law defines the national cooperative policy and establishes the legal regime for cooperatives (Brasil, 1971). Additionally, there are the Federal Constitution, codes, decrees, state laws and municipal laws, among others.

Law nº 10406, January 10, 2002, in its Art. 1094 (Brasil, 2002), says that cooperative societies have the following characteristics: the variability or waiver of social capital; the contest of partners in the minimum number necessary to compose the administration of the company, without limitation of the maximum number; the limitation of the value of the sum of shares of the capital stock that each partner may take; the non-transferability of capital shares to third parties outside the company, even if by inheritance; the *quorum* for the functioning and deliberation of the general meeting, based on the number of members present at the meeting, and not based on the represented capital stock; the right to a single vote in the resolutions for each partner, whether or not he/she has capital in the company, and whatever the value of his/her participation; the distribution of the results in proportion to the value of the operations carried out by the partner with the company, with fixed interest being attributed to the paid-in capital; and the indivisibility of the reserve fund among the partners, even in the event of dissolution of the company.

Still on the regulations for cooperatives in Brazil, the Federal Accounting Council (CFC), through the General Technical Interpretation (ITG) 2004, November 24, 2017, approved the regulations applied to the cooperative entity. In addition, it defined that:

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the cooperative entity carries out activities in the form of a specific law through cooperative acts, which are converted into the provision of services to members, without the objective of profit, in order to obtain better results in common for each of them in particular (CFC, 2017, item 3).

Several studies were developed with the purpose of highlighting the effectiveness of this organizational segment that emerged as an alternative between capitalism and socialism. For example, Álvarez and Salazar (2011) highlight the key conditions for the success and sustainability of solidarity enterprises in Medellín. Souza, Paula and Souza-Pinto (2012) address the role of recycling cooperatives in post-consumption reverse channels. Silva and Andrade (2014) highlight community tourism in favelas.

This topic was presented with a brief description of the history and regulations of cooperatives, which is followed by the section that will address knowledge related to the history of accounting.

2.2 Knowledge related to the history of accounting

The history of accounting is as old as those lived in prehistoric times (Sá, 1997). In this perspective, several scientific accounting trends emerged (substantial materialism, personalism, controlism, reditualism, azendalism, patrimonialism) that complemented and consolidated the concept of patrimonialism so well accepted in Brazil. However, from the first decades of the 19th century onwards, the accounting scientific mentality was expressed in a more systematic way about the patrimonial substance, inserted in the social cells (Sá, 1997); although, when compared to other sciences, accounting was left at the mercy of temporal inertia (Marion, 2009).

At the time, the capitalist system signaled interests, causing mercantile crises and human concerns, fundamental characteristics for thinking, meditating and analyzing to be added to accounting. Thus, it would be possible to understand that it was not only satisfactory to record the accounting facts in the respective accounts, but it was also important to understand the accounting facts. In this way, accounting science emerged with its own systematic method, apparently similar to exact science, but its prevalence was social, and its improvement and development was indispensable, both for the capitalist system and for society (Marion, 2009).

Accounting as a social science, available to economic-administrative entities, generates essential information with regard to the assessment of patrimonial wealth and the implications produced for management (Franco, 1997). Allied to this availability, accounting has specialized over time to generate information that meets the needs of entities, such as Financial Accounting, Management Accounting, Cost Accounting, among others.

The evolution of accounting showed that the specifics could resemble or even be the same at some point. However, different demands from users made the specifics distanced. According to Frezatti, Aguiar and Guerreiro (2007), Management Accounting is an expansion of Financial Accounting. On the other hand, Kaplan and Atkinson (1998) reveal that, as they present different needs, Management Accounting and Financial Accounting need to take different paths.

According to Rodríguez and Montañés (1997), Financial Accounting was the first to emerge, whose main attributions are to record, classify and analyze the accounting facts arising from transactions that occur in the external environment of companies. Financial Accounting still configured the general accounting traditionally used in the organizational scope in a

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mandatory way and, for a long time, had the objective of meeting the fiscal, legal and regulatory requirements to demonstrate to internal and external users the financial situation of the entity.

On the other hand, Johnson and Kaplan (1993) defined the emergence of Management Accounting in the early 19th century, precisely in 1812, at the time of the Industrial Revolution, as a complement to Financial Accounting. It occurred for the first time in the United States, when commercial organizations, instead of depending on external markets for direct economic exchanges, began to conduct internal economic exchanges.

According to Anthony (1970), Management Accounting is concerned with accounting information conducted for management. The author also states that the specifics do not present a precise description of the scope of its activities, since all accounting is financial because all accounting systems are expressed in monetary terms; while it is managerial as it is responsible for the essence of the content of the Financial Accounting reports. The separation in these two groups, thus, results in the understanding that users are different, as well as the needs, understandings and expectations of using accounting information are also different.

In this scenario, it is a fact: accounting has its well-defined space within organizations, and over the years, both financial and managerial accounting has evolved with society, improving information for decision-making, taking into account the technological evolution, relevant for the provision of accounting and financial information in real time in the corporate environment.

Thus, this section was presented, following with the topic that will deal with previous studies related to cooperatives and accounting.

2.3 Previous studies related to cooperatives and accounting

The cooperative theme has been the object of studies from different perspectives. With regard to accounting, Kowalski, Fernandes and Faria (2010) highlighted the importance-performance relationship in the internal controls of an environmental aspect in electric energy cooperatives in Santa Catarina. Martins, Protil and Doliveiras (2010) found that benchmarking, which consists of the process of seeking the best management practices, is still used in a poorly structured way by cooperatives from Paraná that participated in the Program for Revitalization of Agricultural Production Cooperatives (RECOOP), in the period between 1998 and 2005. Munaretto and Corrêa (2016) analyzed the use and purpose of organizational performance indicators in electrification cooperatives.

Regarding credit unions, i) Lima and Amaral (2011) analyzed the importance of these institutions, focusing on the default of credit portfolios; ii) Trindade and Bialoskorski Neto (2012) analyzed the main governance practices, correlating variables that characterize size and financial scale, in particular the variable between ownership and management; iii) Barroso and Bialoskorski Neto (2012) developed an accounting model to calculate the financial spread; iv) Gollo and Silva (2015) investigated global efficiency in economic-financial performance and showed that the most efficient cooperatives are affiliated to Sicoob and Unicred, and the least efficient are affiliated to *Sicredi*; v) Bittencourt and Bressan (2016) analyzed the relationship between assets and liabilities of cooperatives by analyzing the capital structure adopted by cooperatives affiliated to the *Sicredi* system.

The study by Ferrari, Diehl and Souza (2011) investigated the use of relevant management accounting information for strategic support and control in cooperatives in Serra Gaúcha and the metropolitan region of Porto Alegre. Isidoro, Facci, Espejo and Garcias (2013) identified the management tools defined by the International Federation of Accountants that are used by cooperatives, and whether or not they impact the result. In

another study, Pletsch and Lavarda (2016) analyzed how Simons' (1995) Levers of Control are used in the management of an agro-industrial cooperative. Ferreira, Lima, Gomes and Bertolini (2017) analyzed the techniques for analyzing projects and investments, adopted by agro-industrial cooperatives in the West and Central-Western regions of the State of Paraná.

Finally, in the following section, the research methodology for the present study is defined.

3   RESEARCH METHODOLOGY

3.1 Description of the procedures used to conduct the research

In order to meet the objective of this study, a systematic literature review was initially carried out, from August to November 2020, on cooperatives and accounting, from 2010 to 2019, comprising the last ten years prior to the research year. The publications were extracted from scientific journals with titles in Accounting. These scientific journals are qualified by the Coordination for the Improvement of Higher Education Personnel (CAPES) in strata indicative of quality - A1, A2, B1, B2, B3, B4, B5, and C (Plataforma Sucupira, 2022), using the *Sucupira* Platform and the Google Scholar database.

The *Sucupira* Platform is a tool available to collect information, perform analyses, evaluations and be the reference base for the National Postgraduate System (SNPG) in Brazil (CAPES, 2020). The Google Scholar database is a virtual search engine very accessible to the academic community. The use of the two databases aimed to increase the number of records of scientific publications for the research, because even if the publications of both databases were indexed in *Qualis*, the classifications of scientific publications were different. For example, scientific publications on the *Sucupira* Platform were more concentrated in strata A2 and B4 (see Table 1); while scientific publications on Google Scholar were more distributed across different strata (see Table 2).

Thus, the study was developed in two phases. In the first phase, the Classification event was selected: Classification of Periodicals Quadrennial 2013-2016 on the *Sucupira* Platform in *Qualis* Periodicals. Subsequently, the Evaluation Area was selected: Public and Business Administration, Accounting Sciences and Tourism. Therefore, the Title: Accounting was adopted. Finally, periodicals classified in strata A1, A2, B1, B2, B3, B4, B5 and C were selected. After these delimitations, 46 scientific publications were obtained that served as a basis for research on cooperative and accounting topics, as shown in Table 1.

Table 1
Number of records of scientific publications by classification of scientific journals on the *Sucupira* Platform

STRATA	A1	A2	B1	B2	B3	B4	B5	C	TOTAL
Scientific publications	0	29	4	2	2	9	0	0	46

Source: Research data (2020).

Following the systematic review, in the Google Scholar database, the option: in any language was selected; and the themes: cooperatives and accounting were adopted for the same period. Subsequently, the strata with the quality indicators were freely observed – A1, A2, B1, B2, B3, B4, B5 and C, as well as the abstracts that were related to the subject in question. Thus, 57 scientific publications were obtained, as shown in Table 2.

Table 2
Number of records of scientific publications by classification of scientific journals on Google Scholar

STRATA	A1	A2	B1	B2	B3	B4	B5	C	SC	TOTAL
Scientific publications	0	8	9	8	0	3	0	9	9	57

Source: Research data (2020).

After all these procedures performed in the first phase, 103 scientific publications were collected, which represented the documents of the studied sample. The final sample size was considered satisfactory by the literature in order to guarantee the convergence of the statistical model and to obtain the clustering rules (Everitt & Dunn, 2001).

3.2 Description of the statistical model

In the second phase, the technique of cluster analysis was applied, an unsupervised classification method, which comprises a set of multivariate statistical methods aimed at classifying objects into different groups, each one having similar objects according to some measure of similarity among them.

Thus, the following methods were used: i) measure of similarity/dissimilarity for quantitative variables; ii) clustering algorithms; and iii) hierarchical clustering method. At the end, a dendrogram is presented – a tree-shaped diagram, i.e., the product of a cluster analysis used, among other applications, in phylogenetics (Everitt & Dunn, 2001).

Similarity/dissimilarity measures quantify the distance among individuals in a sample. Through these measures, criteria are defined to assess the proximity between two points and, therefore, identify whether or not they belong to the same group.

As part of the data transformation process (ETL process), all numbers and special characters were removed, leaving only the texts of the sample documents. Subsequently, a matrix was constructed with the count of words for each document (document term matrix). Words were found in columns, sample documents were indexed in rows, and frequencies were found in cells (Ailem, François and Nadif, 2015).

Each row of the matrix was viewed as a multidimensional vector, and the angle between two documents could then be calculated, and the measure related to the angle between two vectors was the cosine:

$$\cos(\theta) = \frac{\mathbf{A} \cdot \mathbf{B}}{||A|| \times ||B||} = \frac{\sum_{i=1}^{n} A_i B_i}{\sqrt{\sum_{i=1}^{n} A_i} \sqrt{\sum_{i=1}^{n} B_i}}$$

Where Ai and Bi with i = 1, $\cdots$, n, are the numbers found in lines A and B. The cosine similarity graph was built with all the cosine values between the documents, in order to facilitate the understanding of the analysis statistic that was applied in the researched documents.

In the clustering algorithm, clustering methods can be classified into hierarchical and non-hierarchical. Hierarchical methods can be agglomerative and divisive. In agglomerative methods, each new group contains the groups from the previous steps. In divisive methods, the new groups are subsets of the groups from the previous steps (Everitt & Dunn, 2001).

In partitioning or non-hierarchical methods, a function that penalizes the *K* heterogeneous groups must be minimized. The number of groups must be established a priori.

These methods do not need the distance or dissimilarity matrix to be used; therefore, they can be applied to larger data sets. A widely used partition grouping method is *K*-means. The hierarchical agglomerative method, also called hierarchical clustering method, was used in this study.

In the hierarchical clustering method, the dissimilarity matrix was used first to find the pair of objects that most resemble each other (those that had the lowest coefficient of dissimilarity between them). Then, this pair was grouped together and considered as a new object. Then, another dissimilarity matrix was constructed and the process was repeated until all objects were clustered into a single large group, resulting in the dendrogram.

The dendrogram is a mathematical and illustrative representation of the entire hierarchical grouping procedure through a tree graph (Everitt & Dunn, 2001). The name of node is given to the bifurcations of the dendrogram obtained from the junction of different groups. By cutting the dendrogram to a desired distance level, a ranking of the numbers of groups existing at that level and the individuals that form them is obtained.

One of the methods to define the number of groups in a cluster is the Elbow Method. The optimal number of groups or class can be defined by compute clustering algorithm, which sets the number of clusters a priori (*k*-means, for example) for different values of K.

$$W(C_k) = \sum_{x_i \in C_k} (x_i - \mu_k)^2,$$

where:
x_i is a point belonging to the cluster C_k;
μ_k is an average of the points assigned to the cluster C_k.

The curve of W (C_k) varying from 1 to K_{max}. is plotted. The value of *K* for a change in curvature (elbow) is considered an indicator of the number of classes. After carrying out these procedures, a graphic representation of the clusters was made, building the dendrogram and displaying the levels of similarity and dissimilarity between the documents.

Once the research methodology was defined, the analysis and interpretation of the results were carried out and are presented in the following section.

4 ANALYSIS AND INTERPRETATION OF RESULTS

4.1 Report of research results

As recommended by Everitt and Dunn (2001), first, the similarity between the documents in the sample was characterized to observe those that have the greatest similarity to each other. Figure 1 shows the cosine similarity graph between the documents. The closer the cosine similarity is to the value 1, more similar the documents are, and the intersection between two documents in the graph is darker. The closer the cosine similarity is to 0, the documents are less similar, and the intersection is clearer between the documents in the graph (Li & Han, 2013).
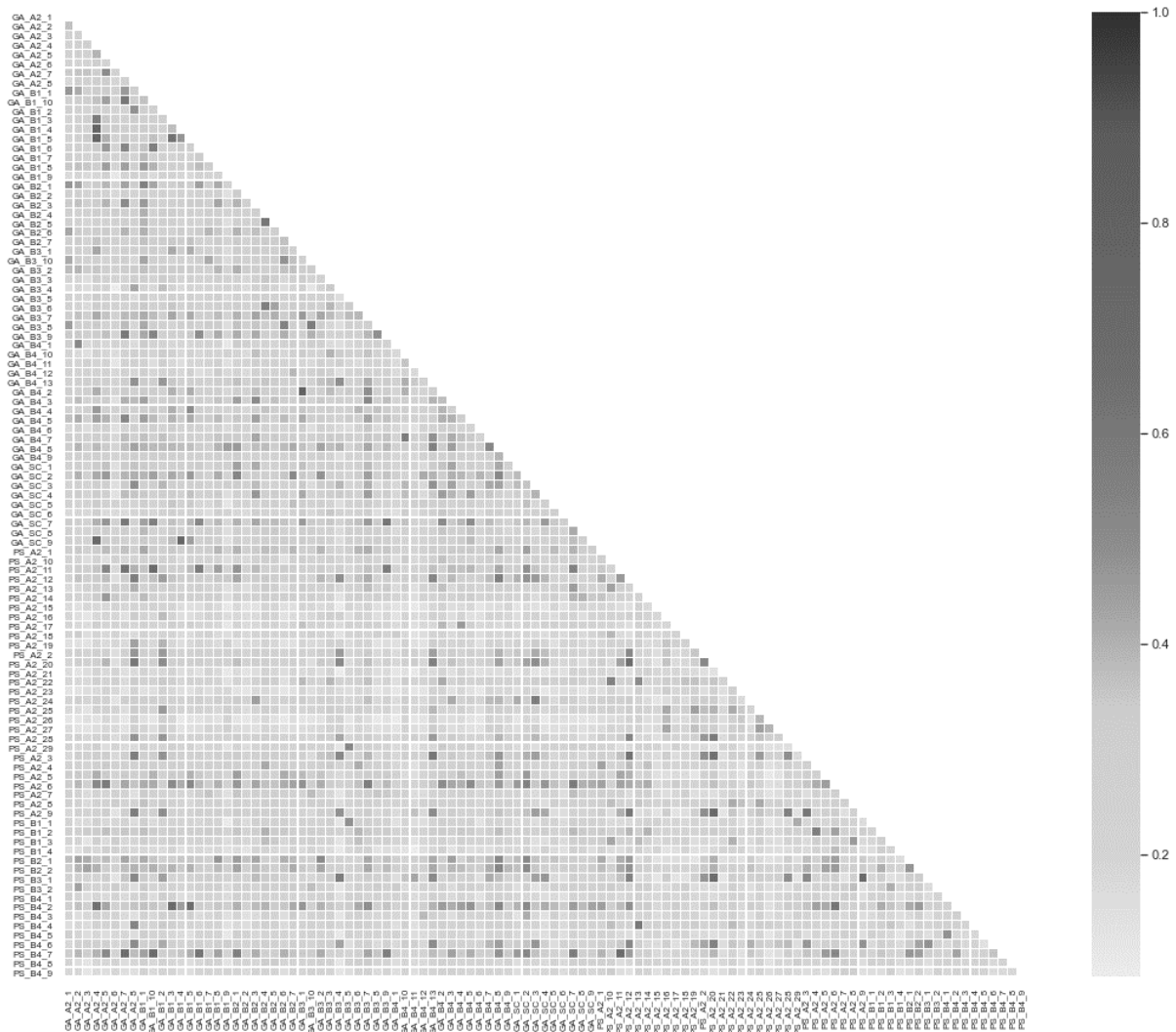
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Figure 1. Cosine similarity graph between documents
Source: Research data (2021).

Note, in Figure 1, that few documents showed a high degree of cosine similarity. In general, after combining the 103 documents researched, three regions with greater similarities (darker regions) were observed. The first region combined documents from the Google Scholar database with documents from the *Sucupira* Platform, with predominance of groupings of documents classified as A2 (GA_A2_1 to PS-A2_14). The second region combined documents only from the *Sucupira* Platform database, with groupings of documents classified as A2 still prevailing (PS_A2_25 to PS_A2_6). The third region combined documents classified as B2 and B4, both from the *Sucupira* Platform (PS_B2_1 to PS_B4_2). In addition, the PS_B4_7 document has similarities with several scientific publications. Among the analyzed documents that presented a high degree of cosine similarity, three blocks were found with nine combinations each, totaling 27 combinations, totaling 54 documents of the 103 documents in the sample, presented in Tables 3, 4 and 5.

Table 3 shows two combinations of a block of nine combinations, with the highest and lowest degree of cosine similarity, referring to the *Sucupira* Platform. The highest degree of cosine similarity was found at 0.709, indicating quality for documents classified as A2. The lowest degree of cosine similarity was found at 0.608, also indicating the quality for

documents classified as A2. The result of the analysis of these combinations confirms the profile of documents classified as A2, a distinct group of scientific production, such as the study by Barros, Albuquerque, Gomes and Dantas (2020) that outlined the profiles of participants in the multidisciplinary program for the treatment of smoking through the clustering technique.

Table 3

Cosine similarity degree between the documents analyzed in the *Sucupira* Platform database

Database	Classification	Cosine similarity	Document number analyzed by classification
Sucupira Platform	A2	0.709	9
Sucupira Platform	A2		20
Sucupira Platform	A2	0.608	9
Sucupira Platform	A2		12
2 combinations			4 scientific publications

Source: Research data (2021).

In Table 4, there are two combinations of a block of nine combinations, with the highest and lowest degree of cosine similarity referring to Google Scholar. The highest degree of cosine similarity was found at 0.797, with an indication of quality for documents classified as B4 and B3; and the lowest degree of cosine similarity was found at 0.604, indicating the quality for documents classified as B2.

Table 4

Cosine similarity degree between the documents analyzed in the Google Scholar database

Database	Classification	Cosine similarity	Document number analyzed by classification
Google Scholar	B4	0.797	2
Google Scholar	B3		1
Google Scholar	B2	0.604	5
Google Scholar	B2		4
2 combinations			4 scientific publications

Source: Research data (2021).

Finally, Table 5 confirms two more combinations from another block of nine combinations, with the highest and lowest degree of cosine similarity, this time referring to the two platforms. The value of 0.690 was found for the highest degree of cosine similarity for documents classified as A2 and B1; and the lowest degree of cosine similarity found was the value 0.606, indicating the quality for documents classified as A2.

Table 5

Cosine similarity degree between the documents analyzed in the *Sucupira* Platform and Google Scholar databases

Database	Classification	Cosine similarity	Document number analyzed by classification
Sucupira Platform	A2	0.690	11
Google Scholar	B1		10
Sucupira Platform	A2	0.606	20
Google Scholar	A2		8
2 combinations			4 scientific publications

Source: Research data (2021).

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Still following the recommendations of Everitt and Dunn (2001), in a second moment the elbow graph was plotted (Figure 2) for the data of the sample documents, it defined the number of ideal groups for a grouping. It is observed that any value between 7 and 12 seems acceptable. For this analysis, seven groups were defined, which at the end are represented in the dendrogram (Figure 4).
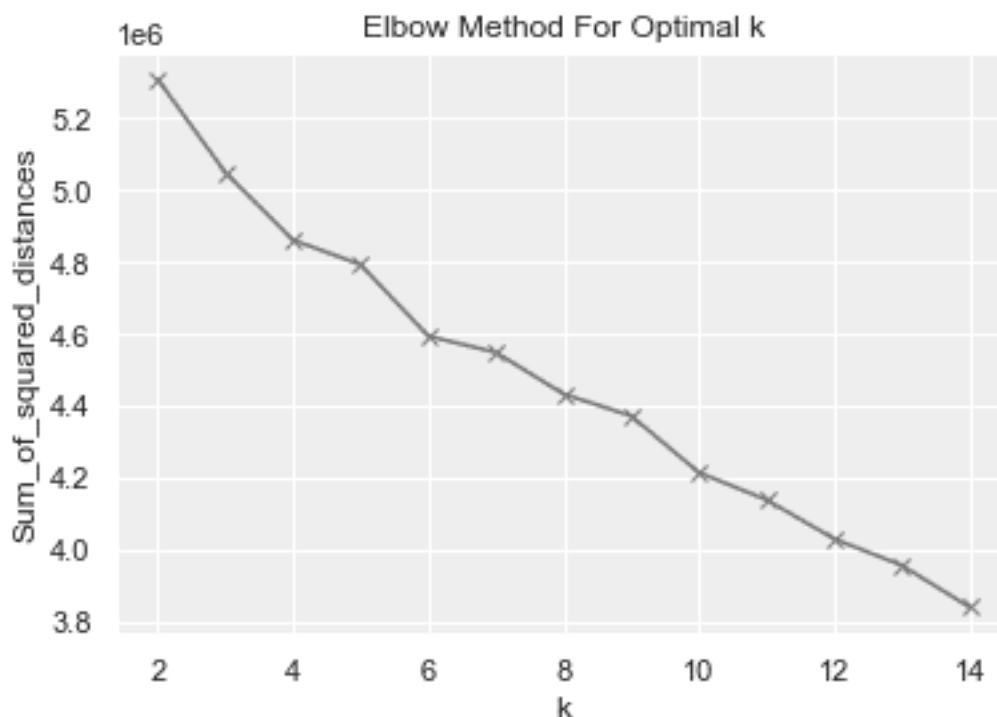

Figure 2. Elbow graph
Source: Research data (2021).

The word cloud (Figure 3) represents group 1, consisting of 23 articles. The main subjects observed for this group are analysis, company, result, study, research and process. This group aggregates an average number of articles and through the most frequent words, it appears that these documents address studies on: the importance of accounting for earnings management; changes in market structures, aligning technological innovations with cost reduction, skills and competencies of accounting professionals in the face of a framework of structural changes in the environment in which companies operate, relating cost management, corporate social responsibility and reflection of information disclosed in relation to sustainability. Thus, the seven groups defined for the study were analyzed and a word cloud was generated for each group, totaling seven word clouds.
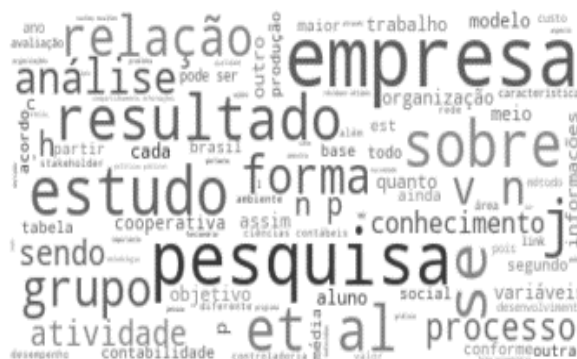

Figure 3. First word cloud
Source: Research data (2021).

4.2 Discussion of results

Table 6 presents the main issues addressed in each group that make up the dendrogram of the analyzed documents (Figure 4). It is observed that only Groups 4 and 5 do not show the issue result, which is always related to management, pointing to a higher frequency for issues related to Management Accounting and mostly in credit unions. The subject company appears in evidence in five groups, generally related to cooperative organizations. There are also issues of equity and assets in evidence in Groups 3 and 4, highlighting the presence of Financial Accounting in studies related to cooperatives in these groups.

Table 6
Main issues identified in each group that make up the dendrogram of the documents

Groups	Main issues				
Group 1	analysis	company	result	study	research	process
Group 2	banco	company	study	analysis	result	management result
Group 3	net worth	result	cooperative	credit cooperative	credit operations	financial institution
Group 4	active	company	cooperative credit	cooperative	entity	net worth
Group 5	cooperative	process	organization	cooperated	research	production
Group 6	cooperative	activity	result	company	cooperated	corporate governance
Group 7	cooperative	result	company	analysis	management accounting	organizational culture

Source: Research data (2021).

Figure 4 shows the mathematical and illustrative representation of the entire hierarchical grouping procedure through a tree structure – the dendrogram, obtained from the junction of the seven analyzed groups that present similarities considering the totality of information of each one, according to the elbow method.

Thus, on the one hand, there was a predominance in the grouping of documents classified as A2 when measuring the similarity between the documents analyzed, both when the documents from the two databases were combined and when only the documents from the *Sucupira* Platform were combined. On the other hand, when analyzing the hierarchy among the seven small groups defined for the study that formed the large group, considering the totality of information contained in each group and the degrees of similarity between them, it was observed the predominance of management accounting in studies that relate to cooperatives, mostly in credit unions. Ferrari, Diehl and Souza (2011), who investigated the use of management accounting information relevant to strategic support and control in cooperatives in Serra Gaúcha and in the metropolitan region of Porto Alegre, confirm these last results.
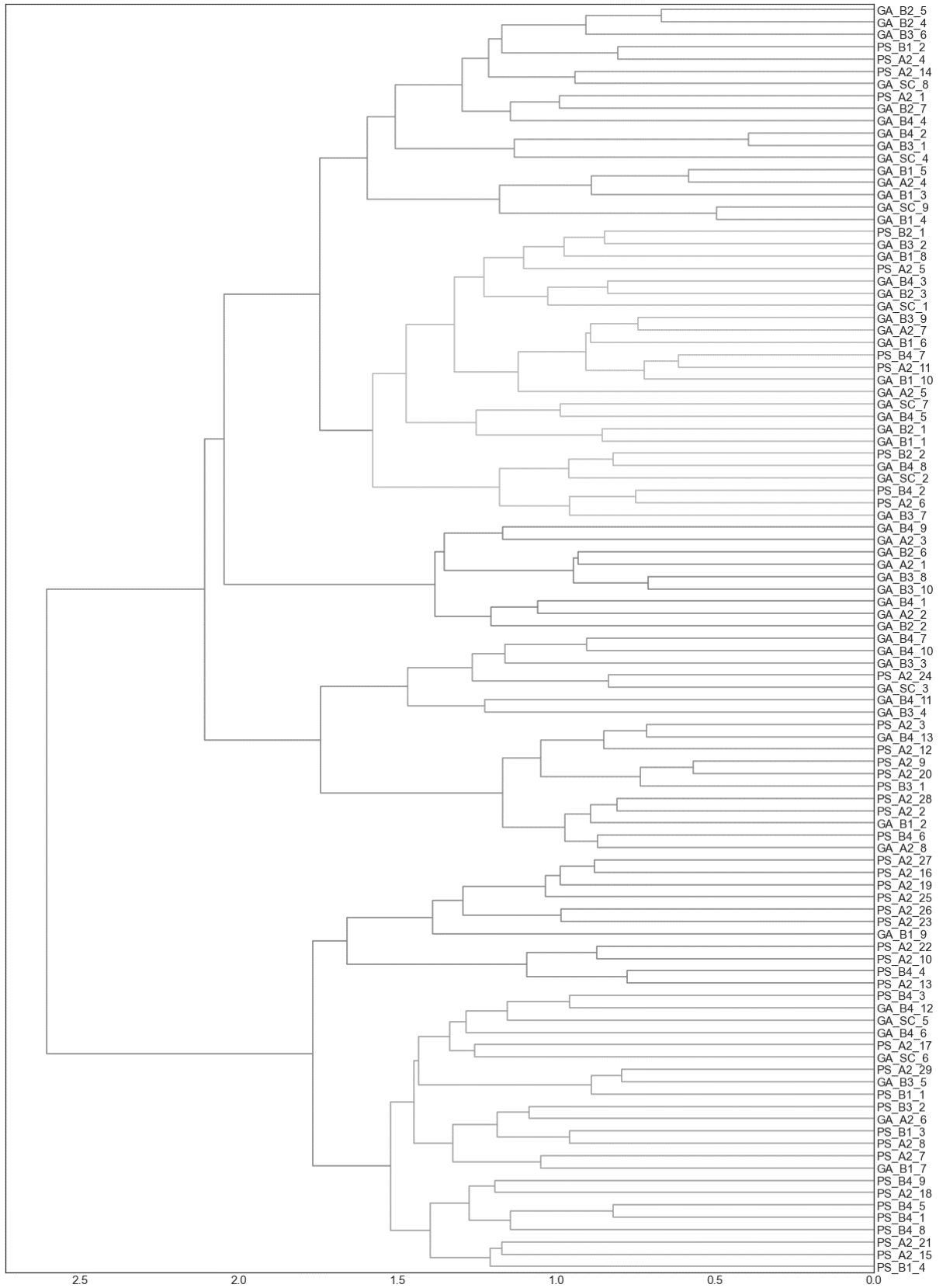
Figure 4. Dendrogram of documents
Source: Research data (2021).

5 FINAL CONSIDERATIONS

This study aimed to analyze the profile of scientific publications on cooperatives in relation to accounting, from the scientific journals of *Sucupira* Platform and Google Scholar, in the light of the unsupervised classification, from 2010 to 2019. The cluster analysis technique was applied as a tool for the analysis of scientific publications, raised in the systematic literature review. Thus, the study was characterized as descriptive and quantitative research. The results indicated the profile of documents classified as A2, and pointed to a higher frequency of management accounting in the scope of scientific publications observed in relation to cooperatives.

In view of these results, the profile of the documents grouped and classified with an A2 quality indicator stood out. This profile is observed both when analyzing the degree of cosine similarity between the documents searched in the *Sucupira* Platform database alone, and when analyzing the documents by combining the documents from the *Sucupira* Platform and Google Scholar databases. Although few documents showed a high degree of cosine similarity among themselves, this profile is evident in the results.

It was also observed that although the accounting legislation provides specific regulations to be applied to cooperatives, establishing minimum criteria and procedures for evaluating the registration of equity variations and the structure of the financial statements, as in the ITG 2004 - Cooperative Entity, the representation of issues related to Financial Accounting is very low. Only about 30% of the sample is related to this accounting specialty.

It was found that approximately 70% of the main similar subjects, considering the totality of information contained in each group, are related to management accounting. This suggests that making decisions based on accounting information reveals a great step towards the promising future of cooperatives, and management accounting can be one of the pillars of this organizational structuring. Thus, it appears that this accounting specialty was used for support and strategic control, suggesting that economic and sustainable growth can be sustained by managing the operational and financial activities of these organizations, either by managing results or by analysis of accounting indicators (Dalchiavon, Wernke & Zanin, 2017; Araújo & Cardozo, 2016; Silva & Andrade, 2014).

In this aspect, in order for cooperatives to expand requirements in terms of public policy to benefit this type of organization, using financial accounting is suggested to provide information to the external user. Thus, it allows better communication between cooperatives and the government, since financial accounting is the provider of information for external users and it serves as a common business language (Jeanjean & Stolowy, 2008).

Another relevant aspect demonstrated in the results was that among the main similarities between the groups analyzed, cooperatives in the credit or agricultural sector are the most evident. In fact, credit unions stand out both in the national and international financial scenario (Bressan, Bressan, & Silva, 2016).

However, it is known that the study is not free of limitations. The first one concerns the number of documents collected. Another limitation is related to the number of databases analyzed. As a recommendation for future investigations, the expansion of the sample is suggested, replicating the research to other databases, allowing the state of the art with studies on cooperatives in relation to accounting.

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O Perfil das Publicações Científicas Sobre Cooperativas e Contabilidade: À Luz da Classificação Não Supervisionada

RESUMO

Objetivo: *O objetivo geral deste estudo foi analisar o perfil das publicações científicas sobre Cooperativas com relação à Contabilidade, extraídas dos periódicos científicos, com títulos em Contabilidade, (i) da Plataforma Sucupira; e do (ii) Google Acadêmico, à luz da Classificação não Supervisionada.*

Método: *Como metodologia, inicialmente foi realizada uma pesquisa sistemática, com os temas cooperativas e contabilidade, nos periódicos científicos, qualificados pela Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (CAPES), com os estratos indicativos de qualidade – A1, A2, B1, B2, B3, B4, B5 e C, compreendendo o período de 2010 até 2019, que resultou numa amostra com 103 documentos. Por conseguinte, foi aplicada a técnica de análise de agrupamentos.*

Originalidade/Relevância: *Ainda não há estudo que analisou o perfil das publicações científicas em cooperativas com relação à contabilidade à luz da classificação não supervisionada; tampouco há estudo que mencionou a especificidade da contabilidade que mais contribuiu no âmbito das cooperativas.*

Resultados: *Os resultados apontam a presença significativa no perfil dos documentos com indicativo de qualidade A2 da Plataforma Sucupira. Ainda dentre os sete grupos analisados, os resultados apontam que apenas 30% dos principais assuntos similares tratam sobre Contabilidade Financeira, revelando que a Contabilidade Gerencial possui forte viés para o crescimento econômico e sustentável das cooperativas no país.*

Contribuições teóricas/metodológicas: *As principais contribuições e impactos deste estudo estão relacionados com a extensão da literatura com os estudos bibliométricos e cienciométricos sobre os temas cooperativas e contabilidade; tornando mais amplos os preceitos da classificação não supervisionada em pesquisa relacionada com a contabilidade.*

Palavras-chave: *Cooperativas. Contabilidade. Classificação não supervisionada.*

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Iolanda Albuquerque Queiroz Oliveira [ID]
Universidade Estadual da Paraíba, PB, Brasil
iolandaaq2013@gmail.com

Ana Maria da Paixão Duarte [ID]
Universidade Estadual da Paraíba, PB, Brasil
anamariapaixao@uol.com.br

Ádria Tayllo Alves Oliveira [ID]
Universidade Estadual da Paraíba, PB, Brasil
adriatayllo@servidor.uepb.edu.br

Kleber Napoleão Nunes de Oliveira Barros [ID]
Universidade Federal Rural de Pernambuco, PE, Brasil
Knnob9@gmail.com