The Influence of Co-Authorship Networks on the Performance of Graduate Programs in the Brazilian Evaluation System

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***Abstract*--In Brazil, CAPES (Coordenação de Aperfeiçoamento de Pessoal de Nível Superior) regulates graduate programs at universities. This agency belongs to the Ministry of Education (MEC) and it is empowered to recommend or discredit graduate courses. Graduate programs are required to coordinate their strategies and actions to comply with the requisites of the evaluation system. This study investigated the influence of "co-authorship networks" on the performance of graduate programs in the CAPES evaluation system. We used a quantitative research method to assess the correlation between co-authorship networks and the evaluations of the programs in the field of Business Management, Accounting, and Tourism, from 2001 to 2009. The results show a positive relationship between the consolidation of co-authorship groups and the score obtained by the graduate programs in the CAPES evaluation system.**

I. INTRODUCTION

Graduate schools have greatly contributed to the development of Brazil through the formation of highly qualified human resource [19], [20] and [21].

According to [1], along with the graduate studies, science research developed by Brazilian universities and institutes has been outstanding in comparison to other countries. It is estimated that by the beginning of the next decade, the Brazilian academic production will be higher than that of Japan and France.

CAPES (Coordenação de Aperfeiçoamento de Pessoal de Nível Superior), a governmental organ responsible for monitoring and accreditation of *stricto sensu* graduate studies programs in Brazil, has been using and perfecting its evaluation system to assess the performance of graduate programs, requiring more strict procedures for quality assessment and, consequently, encouraging continuous improvement of its system [31].

Among the various strategies and actions adopted by graduate courses to facilitate professors' work, we observed the strengthening of research groups and consequently co-authoring networks, which are contributing effectively to achieve better research results in all fields of study [26]. Researchers are also developing *software* programs to monitor the performance of the programs, for example, the *Scriptlattes* was developed at the Institute of Mathematics and Statistics, at the University of São Paulo – IME – USP – to follow up the formation of co-authoring networks, the subject approached in this paper [27].

This *software* facilitates the assessment analysis of how faculty members form their co-authoring networks. In this research, where co-authoring networks were assessed in each program, the professors belong to permanent faculty staff [27].

Thus, we will use this technology to answer the question: How did co-authoring networks influence the performance of graduate programs in the fields of Business Management, Accounting, and Tourism in Brazil from 2001 to 2009?

To answer this question, we conducted a study on CAPES data records to investigate how professors joined to form their co-authoring networks between 2001-2009 within their graduate studies programs and the impacts of this grouping on the assessment of the graduate program carried out by CAPES.

II. EVALUATION SYSTEM OF GRADUATE STUDIES PROGRAMS IN BRAZIL

The evaluation system of graduate programs in Brazil coordinated CAPES comprises an annual assessment by means of the data supplied into the system known as "CAPES Collection" and a triennial evaluation of the performance of all programs and courses that integrate the National Graduate System (SNPG).

The results are expressed by scores ranked on a 1-7 scale for the resolution of the National Council of Education – CNE (MEC) for the courses that attain a status of "recognition", that is, that will have the score equal to or greater than 3 to have effect in the subsequent three years [6].

The system evaluates nine areas of knowledge, denominated by CAPES as Agricultural Sciences, Biological Sciences, Health Sciences, Exact and from Earth, Human Sciences, Applied Social Sciences, Engineering, Linguistics, Language and Arts and Multidisciplinary, totaling 3, 412 recommended programs that contemplate 5, 096 courses [7].

The evaluation of graduate programs consists of two processes. First, the evaluation of graduate programs, and second, the assessment of proposals for new programs. The evaluations are conducted by ad hoc committees linked to the IES of all regions of the country. During the evaluation, committee members use charts to record ratings, ensuring a basis of uniformity and standardization of the evaluation and expansion process, considering the specificities of each area and peculiarities already established. The objective is to guarantee the level of integration between the fields under in

large field and in the context of all the others. The evaluation sheets, along with desktop documents and evaluation reports, constitute the trinomial that expresses the processes and the results for the triennial evaluation [6].

For all fields of study, the programs assessment is structured and drafted taking into account the following requirements: I – Program Proposal; II – Faculty Members; III – Student Body; IV – Intellectual Production; V – Social Insertion.

Given that, the focus of this study is co-authoring networks among faculty members of programs (internal networks of co-authoring), we present a detailed description, based on the area Document of 2009 – a CAPES report about Intellectual Production in the fields of Business Management, Accounting, and Tourism.

IV - Intellectual Production: The following items account for 35% of the total weight of the evaluation, therefore, they are observed and evaluated in terms of allocation of respective weights to compose the total weight of the criterion: a) qualified publications of the program by permanent professors (40% of the weight); b) distribution of qualified publications among faculty members of the program (30%); c) development of techniques, patents and other productions considered relevant (15%); d) artistic productions, in areas where such production is relevant (15%).

According to [40], CAPES triennial review underlines the importance of scientific literature in journals, since it consists of or relates to several items of the evaluation issues. For example, in the question regarding the ad hoc committee that evaluates the percentage of academic production, research projects with external funding and others.

Thus, academic production is evaluated through a scoring system called Qualis [40] and to apply the scores, CAPES provides the committee a table with the scores for each intellectual production in the fields of Business Management, Accounting, and Tourism.

To comply with all the requirements and items, each program must submit to the committee, a plan of actions with coherent and consistent proposals with their contribution to the country's development, demanding that those involved with the programs, especially their managers represented by the coordinators, develop their strategies for the development and maintenance of projects.

For [29], although the adoption of strategies by IES has intensified since 1990, several authors [3]; [4]; [16]; [17]; [18]; [30] have already shown the importance of planning and strategic management to IES.

Among the five items of the evaluation system, academic production seems to be the most important, since the results of professors' work directly reflect on all items of CAPES assessment and, in this case, course coordinators should concentrate on drafting the strategic plan and its implementation to provide real conditions for the development of the professors' work [21].

In fact, for [23], the faculty plays a major role in determining the strategic positioning of a program. This is corroborated by [24], who states that "the scientific production is one of the most relevant dimensions for the evaluation of graduate programs in Brazil". To improve the results in their assessments, the scientific literature should be disseminated and it is the faculty's responsibility to disseminate it, according to [45].

A. Co-Autorship Networks Among Professors

Among the actions developed in graduate courses to comply with some of the required items of CAPES evaluation system, we identified the "co-authorship networks", which was investigated to understand the structure of intellectual production, through the social network analysis applied to co-authoring between authors and institutions [35], [36], [37], [38] and [39].

According to [26], this action is a strategic response adopted by Brazilian graduate programs to the CAPES evaluation system, and [10] stated that, through networking, graduate programs clearly show the potential of co-authoring.

Currently, researchers in collaborative networks can complete their research using available technologies. For [34], in the 1980s, the analysis of social networks was not used in Administrative Sciences, but before the second-generation computers (when transistors began to replace valves - between 1959 and 1965) researchers found methodological difficulties to analyze complex organizations of networks with a large number of actors.

Still, according to author, during the 1980s, several studies were developed to analyze the organizations about the prospect of social networks, such as [2], [32], [33], [43], and [44].

For [34], the networks can be classified in various ways (Table 1).

TABLE 1 – CLASSIFICATION METHODS OF SOCIAL NETWORKS

Methods	Characteristics
By structural properties	Dense or sparse; stable or not; centralized or decentralized; connected or disconnected.
By contact	Formal or informal; strong or weak; frequent or rare; highly emotional or purely utility.
By transactional content	Affection expression; information exchange; influence or material resources.
Links between actors	Intensity or symmetry.

Source: Adapted from [34].

Based on the assumption that scientific knowledge is socially constructed, collaborative networks have gained visibility in the academic area, because researchers have identified cooperation between the graduate programs and among researchers for the dissemination and strengthening of research and of the programs. [38] and [39] supported this idea and stated that social relationships have a fundamental role in the construction of scientific knowledge.

Accordingly, researchers from various fields have concentrated their efforts on studies on this cooperation and networks of collaboration, under various aspects, namely [5], [9], [13], [15], [23], [26], [37], [38] and [39]. Analyzing such networks and collaborations between graduate programs, the authors agree that the networks contribute positively with all actors involved, since they enable reflections of the actors on the production of existing knowledge, with discussions about surveys conducted, favoring the continuation and consolidation of the specific area of knowledge (Gallon et al., 2008).

[28] developed a free-*software* called *Scriptlattes* to investigate collaboration networks in the academic setting. This *software* allows the automatic compilation of bibliographic, techniques and artistic productions, guidelines, research projects, awards and titles, a graph of collaborations, and a geolocation map of a set of registered researchers in Lattes platform. Networks can be represented in several ways, such as teaching-to-teaching, between universities, from an institute to another. Each node can represent, according to the analysis, an author, an institution, or an institute. Some of the most relevant aspects of the *software* are the samples from the presentation *layouts*, in which the most active author appears in the center, around this author, other less active authors come in increasingly larger rays. This allows understanding such interactions, because a given professor interacts more than others do, comprising the existing collaborations or even increasing the group collaboration.

III. RESEARCH METHODOLOGY

The work is characterized as a descriptive research, because it has the characteristics of certain aspects of the programs, with regard to their development and the strategies adopted to compose co-authoring networks, considering the compliance with the "Intellectual Production" of CAPES evaluation.

This research is also considered as documentary, an in-depth study of the CAPES evaluation system and reports information provided by programs and made available on the CAPES website through the numbers of notebooks.

To understand how population data were obtained, that is, data on programs in three-year periods between 2001 and 2009, some observations are necessary:

a) **Number of Notebooks**: between 2001 and 2009, the programs provided to CAPES 6,818 indicators notebooks, and within this period, the number of notebooks delivered had a significant increase from 273 in 2001 to 1,100 in 2009;
b) **Number of Programs**: in 2001, 39 programs obtained scores in CAPES evaluation system, while in 2009, the number of programs that obtained scores surpassed 100, showing the increase of the area.

A. Collection and/or Sampling Techniques

For the data collection process adopted in the first phase of the research, it was necessary to know the virtual environment, its structure and the way that the information and data were made available on CAPES website. Afterwards, we implemented the systematic collection of secondary data, as follows:

a) **Identification of Programs**: we elaborated a programming logic (macro) that downloaded and saved all the indicators notebooks automatically and individually. The programming logic developed allowed each file accessed to be saved in folders that contained the same names of programs on CAPES website;
b) **Lists of Professors**: the data analysis of the indicators notebooks allowed to raise adjustments made by programs over the years in relation to their permanent professors, since every year the programs presented lists with different numbers and names of professors;
c) **Bibliographical Production Collaboration Network**: we extracted data from the Teaching Notebook – Performance – DA – for the analysis of collaborative networks of faculty members of the programs. For that purpose, the *software Scriptllate* allowed the investigate collaboration of networks in bibliographic production, which enriched the research with new comparative scenarios between the programs.

In this research, for automatic compilation performed by *software*, we considered six types of productions to generate the reports, which are: a) full papers published in journals; b) books published/organized or edited; c) book chapters published; d) full papers published in congresses proceedings; e) expanded abstracts published in congresses proceedings; and f) abstracts published in congresses proceedings.

Finally, the option to use this *software* was also supported by the possibility to generate results and graphs automatically. Prior to this solution, according to [26], the research results were generated by manual counts of academic productions, which caused delays.

d) **Co-authoring Network Analysis**: the co-authoring networks were analyzed by means of the techniques of co-authoring networks, in order to characterize the behavior of the programs for each triennium.
e) **Data Analysis (Chi-square):** to verify whether completion of works with or without co-authoring cause

any change in performance of programs, two hypotheses were formulated:

• H_0: performance of the programs scores regardless works with or without co-authoring;

• H_a: performance of programs scores depending on works carried out with or without co-authoring.

To confirm this finding, we used the Chi-square test through the program IBM SPSS Statistics version 20. This non-parametric test, according to [25], is recommended for the analysis of results that show paired data (before and after) in order to verify that the analyzed variables are independent or related.

IV. ANALYSES AND DISCUSSION OF THE RESULTS

We identified, by means of the data collected from CAPES website, the consolidation of networks of relationships among faculty members of the same program. We observed that with the networks of relationships, discussions of studies were strengthened and, consequently, more consistent productions and more publications in periodicals and events scored in Qualis.

One of the effects of the strategies adopted by the programs was the consolidation of co-authoring networks among faculty members of the same program. *Scriptlattes* allowed to automatically generating, for all lists of permanent professors of programs, reports of academic productions, graphs/networks of collaboration, adjacency matrices, which allow to measure the behavior of the professors' collaboration.

To demonstrate the results and number of programs, curriculums and productions analyzed, we decided to introduce them in descending order of scores of programs, starting with programs that featured score seven in the triennium of 2007-2009 and ending with those that did not obtain a score (Table 2)

Most programs that had their scores increased in the trienniums reviewed were also those that, among the analyzed curriculums, conducted co-authored research (Table 2). Therefore, in order to verify whether there is any relationship between these variables, the statistical method called Chi-square ($\chi 2$), whose data from Table 2 were grouped and formed the basis for this analysis, is shown in Table 3.

Table 3 summarizes the number of programs, the performance of their scores in the analyzed trienniums. The table also shows the distribution of curriculums that performed works with or without co-authoring. It seems that a significant relationship occurs between this distribution and the performance of the programs. To investigate this relationship, the Qui-square test was used in the program IBM SPSS Statistics version 20 and the results were the following:

TABLE 2: NUMBER OF BUSINESS MANAGEMENT, ACCOUNTING, AND TOURISM PROGRAMS, CURRICULUMS AND PRODUCTIONS ANALYZED DURING THE PERIODS OF 2004-2006 AND 2007-2009 OF THE PERMANENT FACULTY

* S/N = no score

	No. of Progr. Analyz.	Triennium 2004-2006					No. Progr. Analyz.	Triennium 2007-2009				
		Score	Analyzed Curriculums			No. Prod. Analyz.		Score	Analyzed Curriculums			No. Prod. Analyz.
			Co-authorship		Total				Co-authorship		Total	
			Yes	No					Yes	No		
	3	**6**	68	44	112	4,486	2	**7**	49	28	77	3,266
	16	**5**	164	168	332	8,605	3	**6**	47	28	75	2,501
	21	**4**	171	102	273	8,866	17	**5**	191	129	320	7,689
	40	**3**	188	195	383	7,181	35	**4**	295	171	466	13,376
	29	**S/N***	4	5	9	159	39	**3**	230	201	431	8,192
							13	**S/N**	18	11	29	560
Total	**109**		**595**	**514**	**1,109**	**29,297**	**109**		**830**	**568**	**1,398**	**35,584**

Source: Prepared by the authors, from the data generated by the *Scriptlattes* program [42]

TABLE 3: PERFORMANCE OF BUSINESS MANAGEMENT, ACCOUNTING, AND TOURISM PROGRAMS, DURING 2004-2006 AND 2007-2009.

	Number of Programs Analyzed	Performance of the score in the Program	Trienninum 2004-2006			Triennium 2007-2009		
			Analyzed Curriculums			Analyzed Curriculums		
			Co-authorship		Total	Co-authorship		Total
			Yes	No		Yes	No	
	43	Increased score	198	122	320	355	226	581
	56	Kept score	133	334	667	428	297	725
	10	Decreased score	64	58	122	47	45	92
Total	**109**		**595**	**514**	**1109**	**830**	**568**	**1.398**

Source: Prepared by the authors, from the data generated by the *Scriptlattes* program [42]

CASE PROCESSING SUMMARY

	Cases					
	Valid		Missing		Total	
	N	Rate	N	Rate	N	Rate
Performance of the Scores of the Programs	2307	100.0%	0	0.0%	2307	100.0%

PERFORMANCE OF THE SCORES OF THE PROGRAMS *CO-AUTHORSHIP CROSS TABULATION

			Co-authorship		Total
			No	Yes	
Performance of the scores of the programs	Increased Score	Count	348	553	901
		Expected Count	422.6	478.4	901.0
		% within performance of the grades of the programs	38.6%	61.4%	100.0%
	Decreased Score	Count	103	111	214
		Expected Count	100.4	113.6	214.0
		% within performance of the grades of the programs	48.1%	51.9%	100.0%
	Kept Score	Count	631	561	1192
		Expected Count	559.1	632.9	1192.0
		% within performance of the grades of the programs	52.9%	47.1%	100.0%
Total		Count	1082	1225	2307
		Expected Count	1082.0	1225.0	2307.0
		% within performance of the grades of the programs	46.9%	53.1%	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	42.351[a]	2	.000
Likelihood Ratio	42.596	2	.000
N of Valid Cases	2.307		

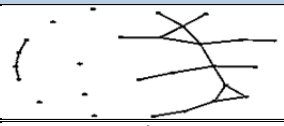
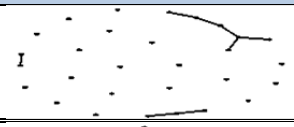
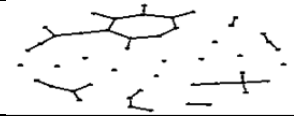
a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 100.37.

The results above show the value of the $\chi 2 = 42.351$ (with significance level $\alpha = 0.05$; degrees of freedom = 2; $p = 0.000$). Therefore, it rejects H_0 when $p \leq \alpha$, and, statistically, it proves that the performance of the programs depends on the completion of works with or without co-authoring. However, the Chi-square test does not allow inferring which of the variables analyzed, in case the works with or without co-authoring, exerted greater influence on the performance of programs. Nevertheless, the results obtained in SPSS show that the best performance occurred when the percentage of work done in co-authoring (61.4%) outperformed in almost 23% those performed without co-authoring (38.6%). This fact did not repeat when the program maintained or decreased its score in the trienniums (maximum variation of 6.2%).

A. Co-authorship graphs

The Scriptlattes program – available in: <http://scriptlattes.sourceforge.net>. – was developed to automatically download the curriculum Lattes (in HTML format) from group of persons of interest group, to compile the productions list and properly deal with duplicates and similar productions. Then reports are generated in HTML format, including productions list separated by type, ordered and chronologically reversed [14]. In the case of the present study, the chronological order began in 2009 and ended in 2004, since there was no information on the faculty of the years 2003 to 2001 available on the CAPES website. The tool also allowed the automatic creation of co-authorship networks between group members.

The graphs were generated from lists of permanent professor considering the trienniums from 2004-2006 and 2007-2009 and for works published among professors from the permanent faculty of the same program. Following Table 4, the graphs are presented according to the program scores, starting with the programs that had the score seven in the triennium 2007-2009 (Figure 1).

Program	2004-2006	2007-2009
UFRGS_Adm		
USP_Adm		

Source: Reference [14].

Figure 1 - Programs with score seven

Two programs that had score six in the triennium 2004-2006 were ranked seven in the triennium 2007-2009. We observed that there is a collaboration of co-authoring in both programs and that USP_Adm obtained a score increase in the triennium 2007-2010. In addition, we observed a better distribution of co-authoring among authors, understanding that this division is based on research lines of each researcher. According to [37], the papers co-authored among small groups can strengthen the publications since the authors create spaces for discussions of their studies.

The UFRGS_Adm program showed a considerable drop of co-authoring in the triennium 2007-2009. This finding also occurred in the assessment made by consultants of CAPES, who reported on the evaluation form of the program and stated that when the patterns of the field study and the average score of professors were very good, the annual average points for literature production by each professor presented a significant increase, which in 2007 was approximately 85 and increased to 135 in 2009. Approximately 80% of the average of the production was performed in journals.

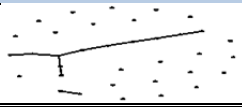
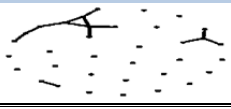
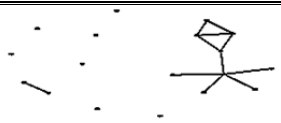
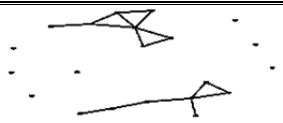
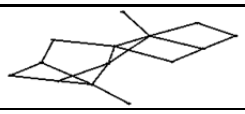
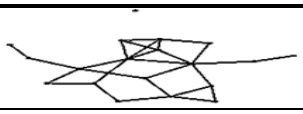
The reduction of partnerships among faculty members may have contributed to the observation made by the evaluators, where, despite the very good performance, there was no uniform distribution of production among the professors. In fact, there was a number of professors of the permanent staff, whose periodic production was low or non-existent. The rate of professors who did not reach the best standard of bibliographic production dropped to a half over three years, reaching approximately 10% in 2009 [8].

Analyzing the networks of co-authoring of the three programs, we observed that FGV_SP_Adm_Emp showed an increase of partnerships and the establishment of groups in the triennium of 2007-2009.

The UFMG_Adm also displayed an increase in partnerships, but we also observed the expansion of one of the co-authoring groups, which moved from two to seven professors in the last three years.

The USP_Control_Cont program showed all permanent professors from the triennium 2004-2006, at some point, aimed to form partnerships within the group to generate productions, which was also observed in the following triennium, in that only one of the 19 teachers did not have production in partnership with other professors of the same program.

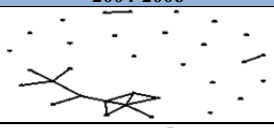
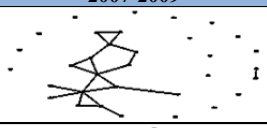
Analyzing the three programs, we observe that all practiced co-authoring and the program that kept score six in the two trienniums began the process of sharing the group of professors, according to their field of research.

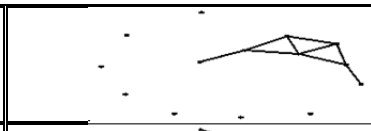
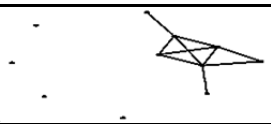
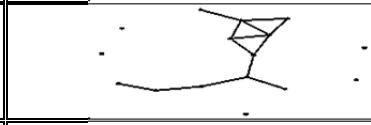
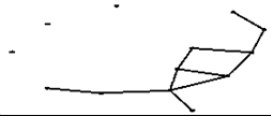
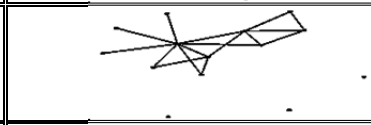
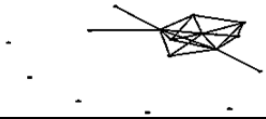
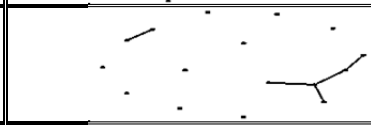
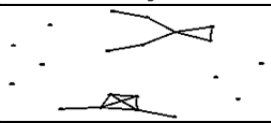
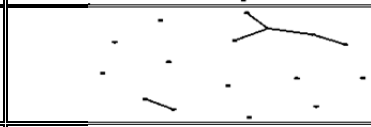
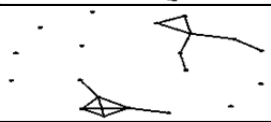
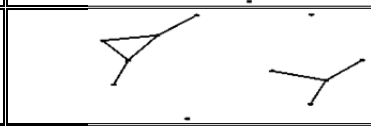
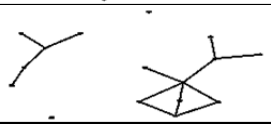
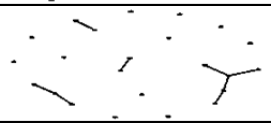
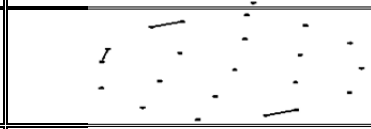
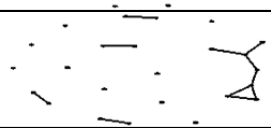
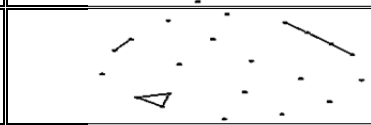
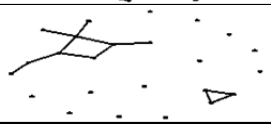
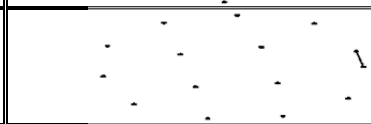
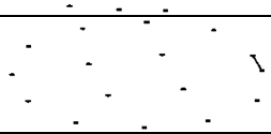
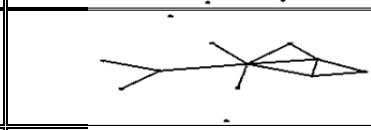
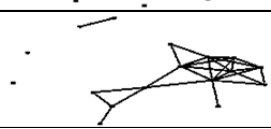
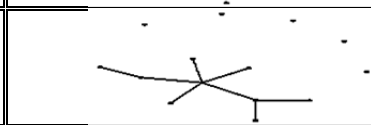
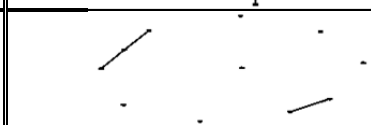
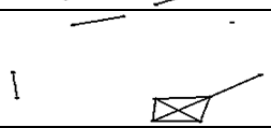
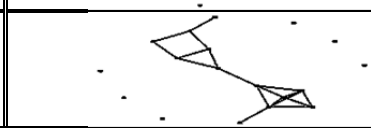
Program	2004-2006	2007-2009
FGV_SP_Adm_Emp		
UFMG_Adm		
USP_Control_Cont		

Source: Reference [14].

Figure 2 – Programs with score six

GRAPHS OF PROGRAMS THAT CLOSED THE TRIENNIUM 2007-2009 WITH SCORE FIVE.

Program	2004-2006	2007-2009
FGV_RJ_Adm		
FGV_SP_Adm_Emp2		
FGV_SP_Adm_Pub_Gov		

FUCAPE_Cie_Cont		
PUC_MG_Adm		
PUC_PR_Adm		
PUC_RIO_Adm_Emp		
PUC_RIO_Adm_Emp2		
PUC_RS_Adm_Neg		
UFBA_Adm		
UFPE_Adm		
UFRJ_Adm		
UNB_Adm		
UNINOVE_Adm		
UNISINOS_Adm		
UNIVALI_Tur_Hot		
UPM_Adm_Emp		

Source: Reference [14].

Figure 3: Programs with score five

All programs practiced co-authoring partnerships differently, and the programs with fewer partnerships were FGV_SP_Adm_Emp_2 and UNB_Adm.

About the 35 programs that obtained score four in the triennium of 2007-2009, comparing grades obtained in the triennium of 2004-2006, 11 increased the scores, 13 scores, three decreased and eight obtained accreditation.

GRAPHS OF PROGRAMS THAT CLOSED THE TRIENNIUM 2007 – 2009 WITH SCORE FOUR

Program	2004-2006	2007-2009
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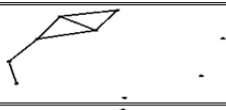
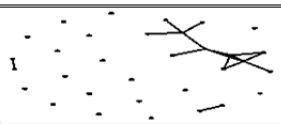
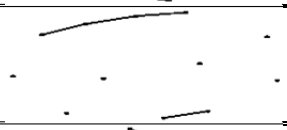
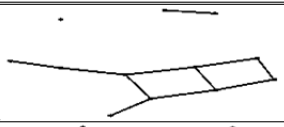
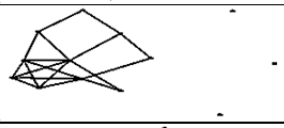
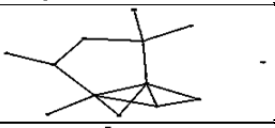
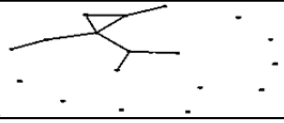
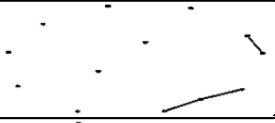
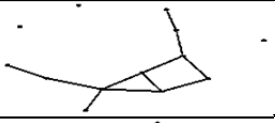
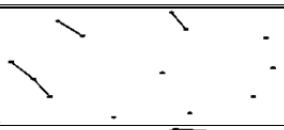
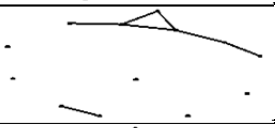
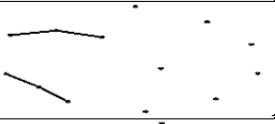
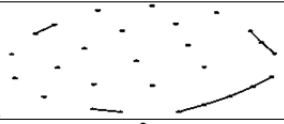
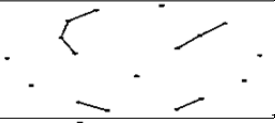
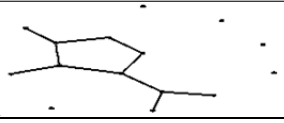
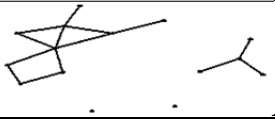
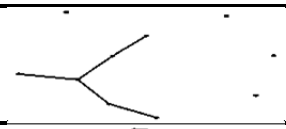
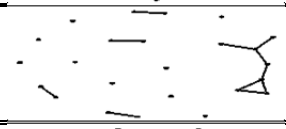
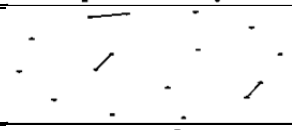
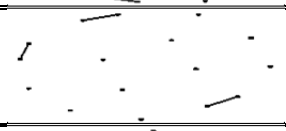
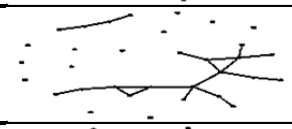
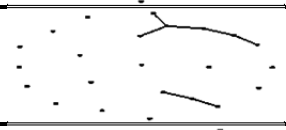
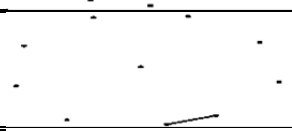
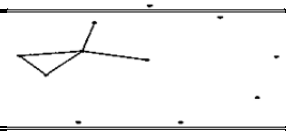
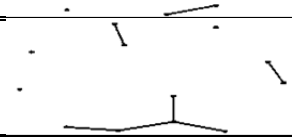
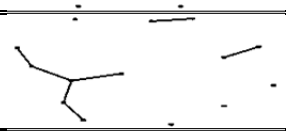
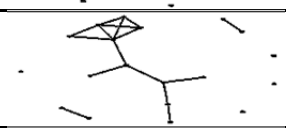
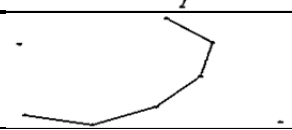
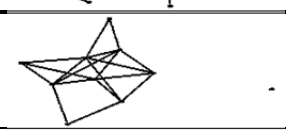
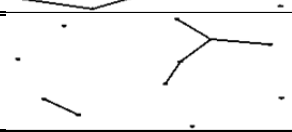
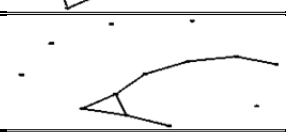
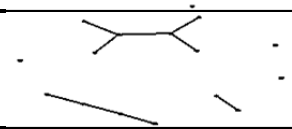
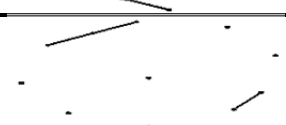
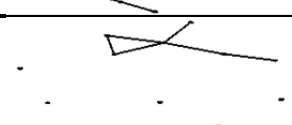
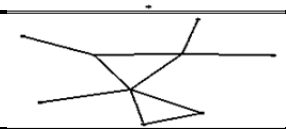
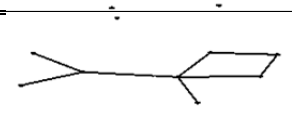
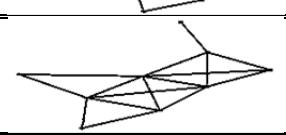
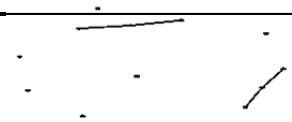
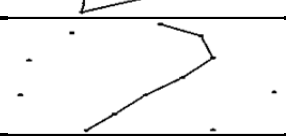
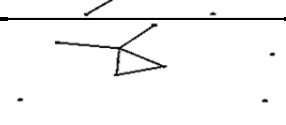
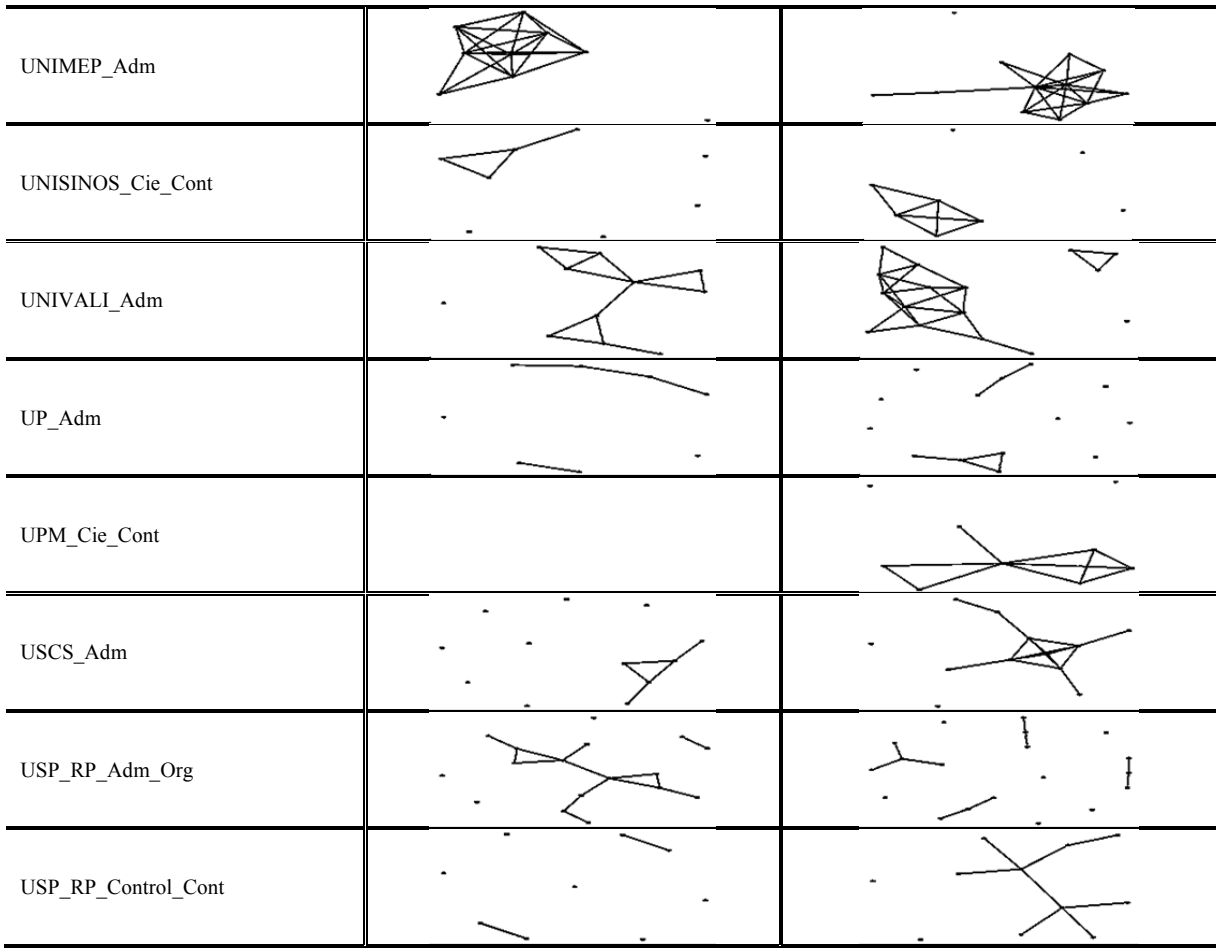
FEI_Adm		
FGV_RJ_Adm_2		
FJP_Adm_Pub		
FUCAPE_Cie_Cont_2		
FURB_Adm		
FURB_Cie_Cont		
IBMEC_Adm		
PUC_MG_Adm_2		
PUC_SP_Adm		
UEM_Adm		
UFBA_Adm_2		
UFLA_Adm		

UFMG_Cie_Cont		
UFPB_JP_Adm		
UFPR_Adm		
UFRGS_Adm_2		
UFRJ_Cie_Cont		
UFRN_Adm		
UFSC_Adm		
UFSC_Cont		
UFSM_Adm		
UNB_Cie_Cont		
UNESA_Adm_Des_Emp		
UniFECAP_Cie_Cont		
UNIFOR_Adm_Emp		
UNIGRANRIO_Adm		



Source: Reference [14].

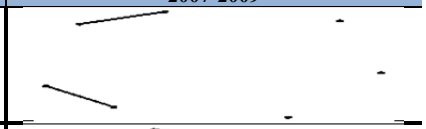
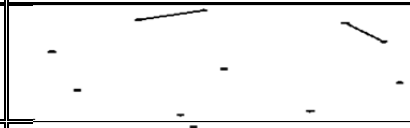
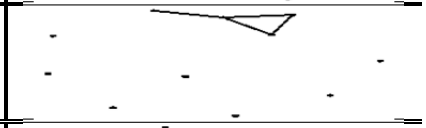
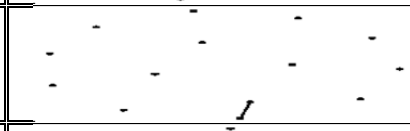
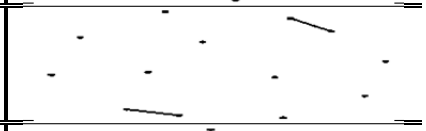
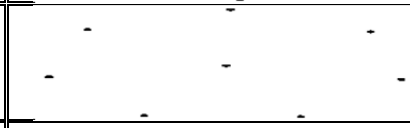
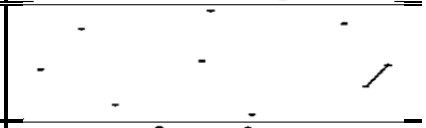
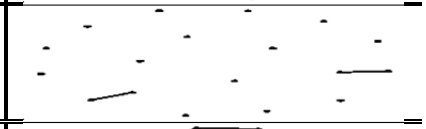
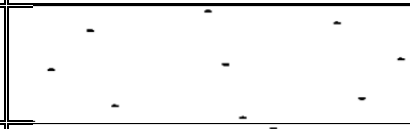
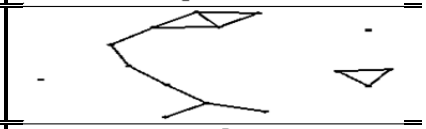
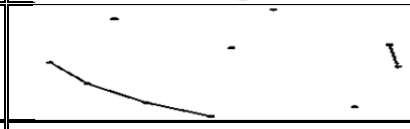
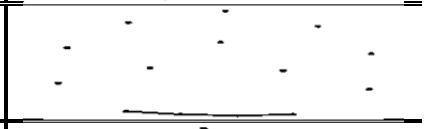
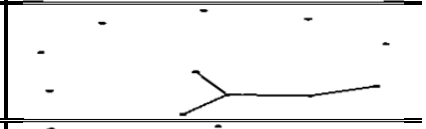
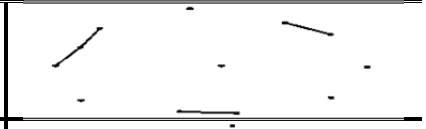
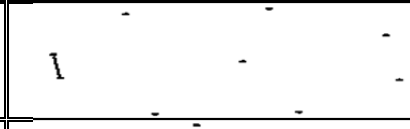
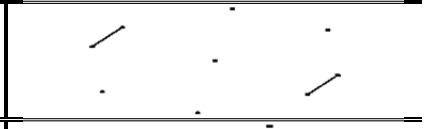
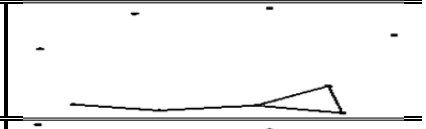
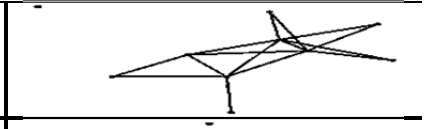
Figure 4: Programs with score four

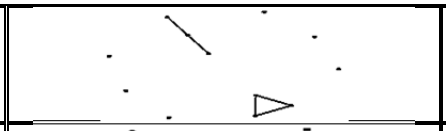
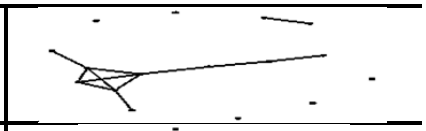
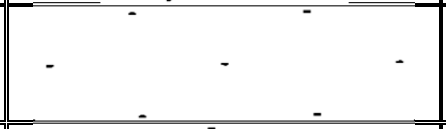
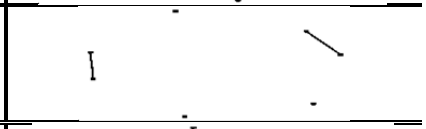
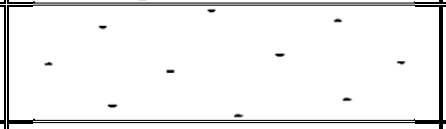
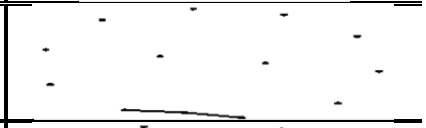
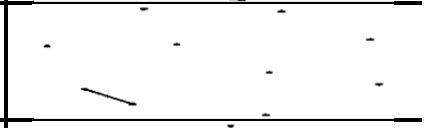
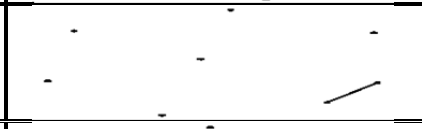
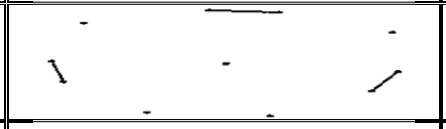
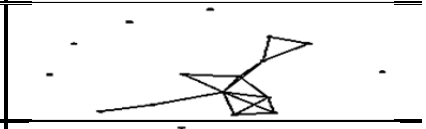
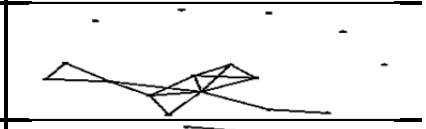
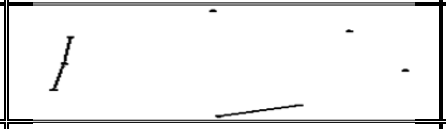
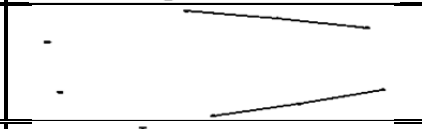
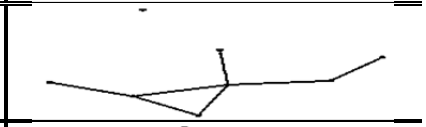
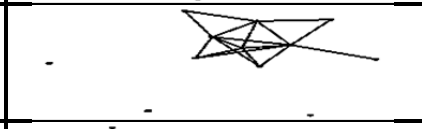
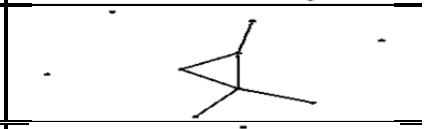
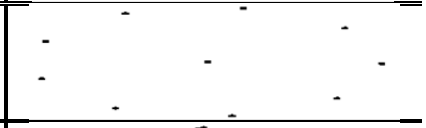
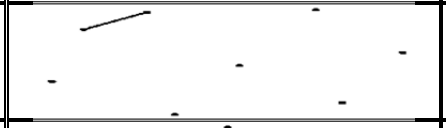
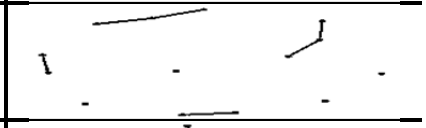
Regarding the networks of co-authoring, we observe that most programs increased partnerships among professors, while a minority kept the same number or decreased the networks.

We also observed that among the networks formed in these programs, the majority does not share their professors in small groups of productions, forming a single network of co-authoring involving professors in the programs, namely FEI_Adm; FGV_RJ_Adm2; FURB_Adm; FURB_Adm; FURB_Cie_Cont; PUC_MG_Adm_2; UFABA_Adm; UFSM_Adm; UFSC_Cont; UFSM_Adm; UNESA_Adm_Des_Emp;UniFECAP_Cie_Cont; UNIFOR_Adm_Emp; UNIMEP_Adm; UNIVALI_Adm; UPM_Cie_Cont; USCS_Adm.

Regarding the 39 programs that closed evaluation of the triennium 2007-2009 with score three, when comparing with the scores of the previous triennium, 24 kept the same score, one decreased from four to three, and 14 obtained accreditation to reach this score.

GRAPHS OF PROGRAMS THAT CLOSED THE TRIENNIUM 2007 – 2009 WITH SCORE THREE

Program	2004-2006	2007-2009
FACCAMP_Adm_MPEmp		
FGB_Gt_Emp		
FEAD_Adm		
FESP_UPE_Gt_Des_ Loc_Sust		
FGV_SP_Gt_Inter		
FNH_Adm		
FPL_Adm		
FUCAPE_Adm_Emp		
FUMEC_Adm		
Insper_Adm		
PUC_SP_Cie_Cont_ Atuarias		
UAM_Hosp		
UCS_Adm		
UCS_Turismo		

UDESC_Adm		
UECE_Adm		
UERJ_Cie_Cont		
UFAM_Cont_Control		
UFBA_Cont		
UFC_Adm_Control		
UFC_Adm_Control_2		
UFES_Adm		
UFMS_Adm		
UFPE_Cie_Cont		
UFPR_Cont		
UFRN_Turismo		
UFRPE_Adm_Des_Rural		
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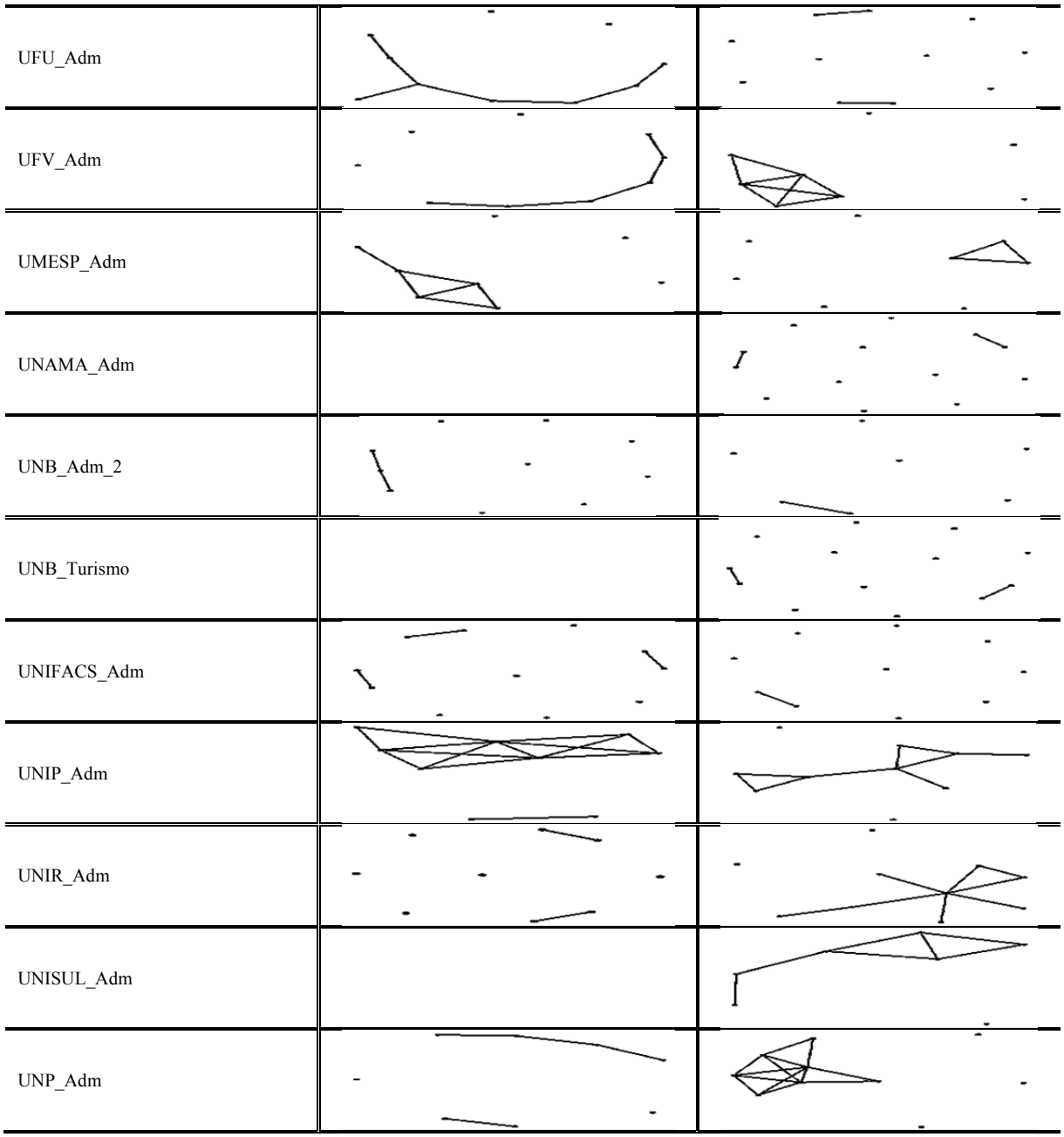


Source: Reference [14].

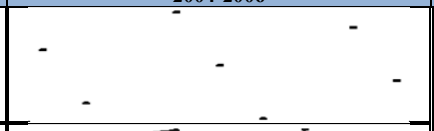
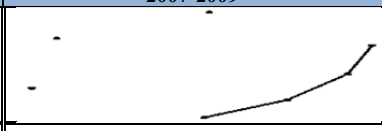
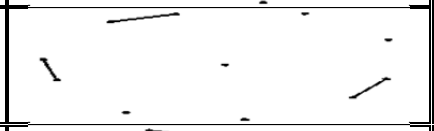
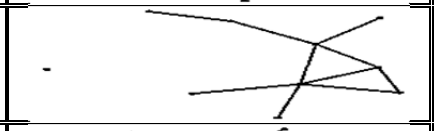
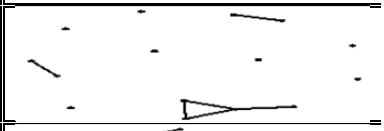
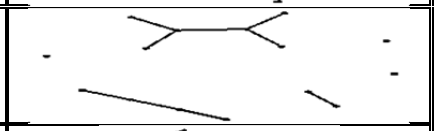
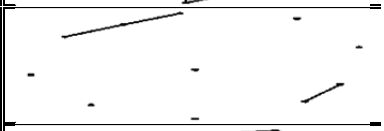
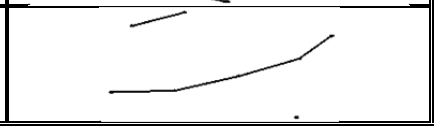
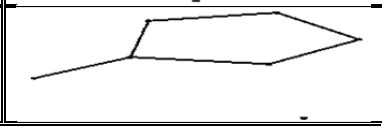
Figure 5: Programs with score three

The UNB_Adm_2 program was downgraded from four to three and it seems that only two professors kept a network of co-authoring.

Some of the programs that were upgraded, coincidentally also increased their networks of co-authoring, as in the case of FUMEC_Adm; UFC_Adm_Control; UFC_Adm_Control_2; UFMS_Adm; UFPE_Cie_Cont; UNIR_Adm; UNISUL_Adm. Others increased the co-authoring networks, however, they kept score three, such as FNH_Adm; UCS_Adm; UDESC_Adm; UFPR_Cont; UNIR_Adm; UNP_Adm. Importantly, most programs increased or initiated their co-authoring networks in the triennium of 2007-2009.

For the 13 programs that ended the triennium of 2007-2009 with no score, we designed a graphical representation of co-authoring of five programs, since there were no data available on CAPES website for the other programs.

GRAPHS OF PROGRAMS THAT CLOSED THE TRIENNIUM 2007 – 2009 WITH NO SCORE

Program	2004-2006	2007-2009
PUC_RIO_Atuaria		
UFC_Adm_Emp		
UNA_Tur_Meio		
UNB_Cont		
UNISANTOS_Adm		

Source: Reference [14].

Figure 6: Programs with no scores

Of the five programs, we observed that, when comparing the triennium of 2004 - 2006 to 2007 - 2009, three programs reduced co-authoring networks, one increased and one kept the same networks.

The analysis of all programs divided by scores obtained in the triennium of 2007-2009 showed that the programs that established and kept or increased their networks had more possibilities to keep or increase their scores in the CAPES evaluation system. In addition, the use of *Scriptlattes* in this analysis as a management tool of the programs allowed a better understanding of the academic productions and co-authoring relationships among professors.

V. CONCLUSIONS

According to [22], the concern with the quality of *stricto sensu* programs offered stems from the structural imbalance between the State, IES and Society. The frequent social transformations require new actions from IES for the mid-term, which fail to respond appropriately to such demands, modifying their traditional structures and modes of operation, without a prior evaluation process.

In this sense, to direct efforts to change and make decisions, it is necessary to know the current situation, the available resources, the existing capacities, and the necessary steps to take. Therefore, for [11], [12] [22] and [41], it is clear that the evaluation is an essential mechanism for the development of systems, organizations, and countries.

To verify the strategies adopted and resources allocated by graduate programs that have excelled in the CAPES evaluation system, as defined in the methodology chapter, we carried documentary research on the indicators notebooks published on CAPES website. The aim of this article is to answer the question: **How the co-authoring networks influence the development of graduate programs in the field of Business Management, Accounting, and Tourism in Brazil between 2001 and 2009?**

The documentary and quantitative research allowed identifying the consolidation of relationship networks among faculty members of the same program. It is inferred that networks of collaborations strengthen discussions of studies and, consequently, generate a greater number and more consistent publications in periodicals and events ranked in Qualis. In most programs, professors formed such networks organically, because they have common topics of interest as they are in the same research line. For [26], it is the result of a strategic action, since it was part of the strategies of the programs to compose groups of professors in the same research line.

The Chi-square test supported the hypothesis that there is a relationship between the performance of programs and academic works with or without co-authoring. The results indicated that the best performance occurred when the percentage of work done with co-authoring surpassed by 23% the ones performed without co-authoring. When this variation does not exceed 6.2%, the performance of the programs between the trienniums evaluated is kept or decreased.

Regarding the limitations of the research, it was observed that it was restricted to deepen the studies in programs that were featured in the CAPES evaluation system in the area of Administration, Accounting and Tourism, it should be noted that to apply it to others knowledge areas, the researcher should check the specialties of the area to be studied.

For future research it is recommended to search for program practices in other knowledge areas, as well as international programs and their evaluation systems, to check how the initiatives for internationalization activities contributes to the scope of action of the Brazilian programs in an international context, with the measurement of investment in front the returns earned and the generation of improvements for the postgraduate programs.

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