REBRAE
Revista Brasileira de Estratégia

doi: 10.7213/rebrae.09.002.AO04 ISSN 1983-8484

Relationship and performance: sociometric and bibliometric study of the scientific production of the graduate program in accounting at Unisinos

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Abstract

The relationship between the ability to relate social actors and their performance has achieved great attention recently, indicating the need for respect among various stakeholders and their environments. Accordingly, following Torres et al. (2013), this article analyzes the scientific publications of the researchers at the Graduate Program in Accounting at Vale do Rio dos Sinos University (Unisinos) from 2007 to 2012 based on their relational perspectives and performance. Based on an analysis of curriculum lattes of those surveyed, and through sociometric methods, bibliometrics, social network analysis, and other statistical approaches, the program was identified and studied. The program has 13 researchers who presented 605 scientific publications distributed among the Annals of Congress and periodicals. These publications represent a score of 1.620 in the first three years (2007-2009) and 3.260 in the second (2010-2012), and were analyzed individually (per researcher) with indicators of the centrality of networks. A descriptive analysis was based on the performance points of the researchers and their relational perspectives, noting, as a final consideration, a predominant direct and persistent association between indicators of relationship researchers and their performance in points (Qualis score).

Keywords: Performance. Bibliometrics. Sociometry. Social Networking.

Introduction

The search for effective performance is a major focus in most markets, including academics. In this regard, Cruz (2012) highlights the importance of understanding the key performance characteristics of each market to examine the efforts required to enhance effectiveness, and describes relationship skills as essential. Thus, the goal of this work, following the work of Rocha et al. (2014), is to study the association between relationships and performance in the Strictu Sensu Graduate Program in Accounting at Vale do Rio dos Sinos University (Unisinos) in Sao Leopoldo, Rio Grande do Sul, Brazil. This program has a Coordination for the Improvement of Higher Education Personnel (CAPES) federal graduate program evaluation score of five specializes in internal audit and finance, and addresses three research topics: accounting for external users, management control, and corporate finance.

For this study, two variables were defined: performance and relationship. Performance (the dependent variable) was based on the scores of the program researchers, obtained by linking published articles to their respective classification in the CAPES platform. Relationship (the independent variable) included the social network analysis indicators of degree centrality, beetweeness centrality, and closeness centrality. An immersion classification was used with these variables, and their descriptively analyzed associations, as proposed by Cruz (2012), test the association between the authors' performance scores and their relational capacities.

This article is divided into the following chapters: Introduction, Theoretical Approach, Methodological Approach, Data Presentation and Analysis, and Final Considerations.

Theoretical approach

The aim of this chapter is to establish the theoretical relationship among the main themes of this study and provide general and specific perspectives on social networks and performance. This theoretical approach is structured based on two main research approaches used in the area in recent years. The first depicts the network as an analysis tool to understand the social relations among a set of actors with different goals (MARTES et al., 2008). The second, referred to as the interdisciplinary approach, regards networks as a form of management of the relationships between economic actors, which is directly related to performance (CRUZ, 2012).

With the predominance of the second approach, the theoretical basis is presented as a single block, separated into two themes, which link the conceptual perspective of networks, the key metrics and forms of immersion, with performance, and constitutively integrates those two issues to provide a theoretical foundation for the central proposition of this study.

Analytical context of social networks

Van Aken and Weggeman (2000) propose that any organization or individual is involved in some form of networking, but some structural and managerial aspects determine the formation of networks in the environment, which can, according to Hutt et al. (2000) become more densely established when actors engage in horizontal and vertical alliances in search of congruent goals. Such reflections were influenced by Powell and Smith-Doerr (1994), who describe a network as a set of relationships among actors with content that defines their type and determines their intensity, and are typically inserted in multiple and even overlapping networks. From a sociological perspective, Granovetter and Swedberg (2001) describe a network as set of regular contacts between individuals or organizations.

Fensterseifer et al. (1997) assert that strong conceptual evidence of networks is present when identifying partnerships, cooperation, and associations, and in the complementarity between organizations and individuals, assuming that, in the present business environment, no company, whether small or large, is independent and self-sufficient.

The analysis of social networks under a conceptual perspective can be regarded as a methodology applied to the study of the relations of actors with objects of any kind (BORGATTI et al., 2002). According to Wellman (1988), social network analysis, as a method, is originally structuralist. However, some key concepts deserve clarification. For analysis, some of the main networks types are as follows:

a. Symmetrical networks: comprise relationships among actors with the same ability to influence. For example, actors have the same relative level of power (OLAVE; AMATO NETO, 2001); and,

b. Asymmetrical networks: characterized by the presence of central agents who yield more power than the other actors (OLAVE; AMATO NETO, 2001).

In this sense, some network analysis indicators deserve special attention, particularly, according to Lorrain and White (1971), measures such as degree centrality, closeness centrality, betweenness centrality, density, geodesic distance, as follows:

a. Degree centrality: indicates the number of ties that an actor has with other actors in a network (FREEMAN, 1979). This is obtained by dividing the observed node degree by the maximum value for a node degree;

b. Closeness centrality: indicates the distance of an actor from other actors in the network (Wasserman, FAUST, 1994). The degree of closeness is calculated by adding the geodesic distance of the node to all other network nodes, then inverting the result, thus obtaining the distance and the closeness. The greater the distance, the lesser the closeness;

c. Betweenness centrality: reflects the interaction between noncontiguous actors. An actor is considered an intermediary if he links several other actors that are not directly connected (Degenne; Forse, 1999). This is measured as the sum of the probabilities of a given node being on the pathway of all other network nodes;

d. Density: this is the ratio of lines on a graph to the maximum possible number of lines (SCOTT, 2000); and,

e. Geodesic distance: this is the shortest distance between two nodes (WASSERMAN; FAUST, 1994).

These concepts are employed in studies to establish a foundation associating the network position with behavior, or to measure the performance of the actors using network measures. However, De Nooy et al. (2005) demonstrated that this association is limited, as such measures are not appropriate for large networks (although the size referred to as large is not clear).

Simmel (1950), supporting the position that there is a positive association, details that the relational structure directly affects its content and performance. Highlighting the importance of this assertion, Mizruchi (2006) states that network analysis can be applied to any empirical subject, focusing particularly on the effects of the centrality behavior of the actors in the network and the effects of the nature of the relationships between individuals and organizations on their strategic behavior and objectives in a time series.

As evidence of this assertion, Mizruchi (2006) cites Leavitt (1951) who shows, through a series of network structures, the influence of greater or lesser centrality of the actors in achieving their goals, leading to a positive association between centrality and performance. This is also confirmed in studies by Cruz (2012), which associate the historical network structure with the performance of its actors, proposing an immersion scale for actors.

The immersion of the actors in a network is characterized by what Uzzi (1996) refers to as embeddedness, which has three components: group problem solving, trust, and transfer of information. Although separate, these elements are linked in a single social structure. Uzzi (1996) indicates that these ties result from social and market relationships, which are related to the concept of embeddedness, defined by Granovetter (1985) as the incorporation of actors in a network structure. Further, embeddedness is an important concept to understand why institutions and networks are assembled, maintained, and transformed (MARTES et al., 2008, p. 27).

Simsek et al. (2003) highlight the existence of three types of embeddedness: structural, relational, and cognitive. Structural embeddedness is the amount of network connections where more bonds between the actors increase the structural embeddedness of the network. Relational embeddedness refers to the content of the relationships comprised of trust and cooperation. Cognitive embeddedness signifies the similarity of goals and social norms among the actors. The first two types of embeddedness are evaluated in this study, with structural embeddedness being related to the stratified centrality indicators and relational embeddedness to the types of relationships in the network, such as the exchange and donation of materials, commercial, funding and incentives, and regulation and development.

Uzzi (1997) states that immersion in networks is subject to the embeddedness paradox. This refers to how processes that generate positive effects on the actors of a network, and the network structure itself, also generate negative effects, depending on three factors: the loss of a central actor in the network, which could impact the viability of the network, changes in institutionalized arrangements, and excessive ties in the network structure, which could lead to stagnation in the innovation processes.

Thus, Cruz (2013), investigating the possibility of relating the immersion of the actors in a network to performance, proposes the following concepts and categorization of embeddedness:

a. Associated embeddedness, represented by the persistent positive association between network variables (degree, closeness, and betweenness) and performance.

b. Unassociated embeddedness, corresponding to the persistent lack of a positive association between performance variables and relationship variables.

These concepts help define whether the impact of actors' behavior on the network is directly associated to the environment outside the network, which directly influences structural and relational embeddedness. This highlights that the embeddedness paradox, described by Uzzi (1997), is moderated by the influence of external (macro) and internal (micro) factors on the relationship between the performance variables and the motivation of the network actors, which are immersed in the specificities of association and lack of association between variables.

It must be stressed that the moderation of the influence of external and internal factors on the relationship among the variables may arise from the symmetry and asymmetry characteristics of the network, as the existence of a central actor in the network structure can lead to a process of selection and convenience. This is less likely when there is symmetry in which, due to the absence of power polarization, all participants have equal influence and relationship opportunities, reducing the likelihood of isolation, even if there is a high degree of immersion between the actors in the network (CRUZ, 2012).

Social networks and performance

The goal of this section is to present a structure for the theoretical relationship between network structure and performance in a time series. Among the main authors to suggest this relationship, Becker (2007) describes that the development of participatory and negotiated network structures promotes the maturation of organizations, establishing an essentially dynamic and evolving relationship and an environment that promotes reflection, implementation, and control strategies focusing on performance (Cruz at al., 2008).

According to Arbix et al. (2001), the congruent goals of a network structure can be achieved more easily by increasing the density of the articulation of the actors involved in a particular market.

Such involvement can lead to more diverse actors, which can allow more easily for local scale actions that enable the direct participation of those involved. This ability to adapt actions to the extremely different conditions that groups face, focusing on performance specific to all actors of the network structure, is one of the most significant local network development advantages (ARBIX et al., 2001).

The variety in the types of actors also generates different perspectives on performance. Cruz et al. (2011) states that performance can be described as the comparison of the result of an action with a pre-established expectation.

In addition to discussing ways of assessing performance and their relevance to the actors in a network, special attention is given to the complexity of measuring the positive association between network structure and the attainment of the goals of the network members. Luitz and Rebelato (2003) highlight this concern, stressing the need for methods of network performance evaluation to assess the achievement

of objectives in relation to expectations to validate the adopted strategies and reassess goals under a temporal and dynamic perspective.

There is relatively little research on network performance evaluation, with few reports concerning instruments to measure the degree of success of these networks and their diverse actors over time (LUITZ; REBELATO, 2003).

It is worth mentioning that a relationship of the networks of a social structure that is focused on performance emerges to strengthen the structure, allowing for greater added value for the actors (KNETEMAN, GREE, 2009). This emphasizes an alternative approach, which is strongly influenced by a neoclassical economic approach, that presents relationships between actors (individuals and organizations) and not just isolated individuals as the focus of analysis (MARTES et al., 2008). This generates a positive correlation between social relationships and the performance of the actors (Granovetter, Swedberg, 2011), which can be primarily measured by structural indicators in a time series (Mizruchi, 2006).

Such evidence has been confirmed by the research of Uzzi (1996) and Cruz (2012), which highlight the interesting relationship between network structure and the degree of immersion of the actors with the performance variables. These studies demonstrate that relationships do not always occur among the same organizations, which would indicate a relationship bias that would directly affect the performance perspective of their actors.

Thus, the positive association between the positioning of the actors in the network and performance deserves special care. Although the theoretical approach used here presents such an association, it is necessary to establish under which metric network analysis it is shown to be positive through a time series.

Under such requirements, Mizruchi (2006) reports a series of studies in which centrality is presented as a primary relational indicator. Accordingly, most of the time series studies that use centrality as a metric reveal a positive association with the performance of the network actors, reinforcing the view that the position of an actor in a network structure has a significant impact on their performance.

Methodological approach

This study employs methods of bibliographic and bibliometric research. According to Padua (2004), the purpose of literature research is to put the researcher in touch with existing research. On the other hand, bibliometric research quantifies the processes of written communication and the use of bibliometric indicators to measure scientific output (OLIVEIRA, 2001). This approach is based on the evident growth of scientific studies and their dissemination through information technology, which creates new knowledge communication channels and causes, in recent decades, a revolution in our perception of the relationship between the production of knowledge, the research, how it is recorded and published, and its reach.

This development has caused much discussion on the importance of metrics to assess the quality of knowledge and disseminating it to academic society and society in general. However, as Vanti (2002) describes, how to diagnose these metrics is an open-ended question. Measuring the productivity of those responsible for the production of knowledge through research is complicated.

One option for control and evaluation is bibliometrics, which is the use of specific techniques to measure the productivity of researchers, research groups, and institutions.

The quest to understand the phenomenon of scientific production and its dissemination is not new. According to Dos Santos and Kabashi (2009, p. 157), "the use of statistical and mathematical methods to map information from bibliographic records and documents (books, articles, journals) do not constitute new facts." In Brazil, bibliometric studies have proliferated since the 1970s (ARAUJO, 2006).

Today, however, derived from statistical bibliography which, according to Campos (2003), was a term coined by Hulme in 1923, the bibliometric method of analysis emerged in the early twentieth century from the studies of Paul Otlet in the 1930s (VANTI, 2002; SANTOS, 2003; DOS SANTOS; KABASHI, 2009). Otlet (1934 APUD DOS SANTOS; KABASHI, 2009) defines bibliometrics as the area concerned with the measurement and quantitation applied to books, such as seeking to measure, monitor, and describe how a given material for knowledge communication is disseminated throughout society.

According to Dos Santos and Kabashi (2009), in the pursuit of understanding the quantification of the products of scientific activities, key authors in the area, such as Lotka, Bradford, Zipf and Price, must be referenced.

Among classical bibliometric laws, Lotka's Law deserves special mention in this work. According to Araújo (2006), Lotka's Law states that a small number of authors produce a large amount of scientific literature, and that a large number of small authors equals in production, a small number of great authors.

Furthermore, Bradford's Law (apud Araujo, 2006), also known as the Dispersion Law must also be referenced. This law deals with publication in journals, such that "if we arrange journals in descending order of productivity of articles on a given subject, it can be distinguished a core of journals more particularly devoted to the subject and several groups or zones that include the same number of items as the core." That is, few journals have the same central focus and several have focuses peripheral to the subject.

The following describes some possible uses of bibliometrics (VANTI, 2002, p. 155):

a. identifying the trends and the growth of knowledge in a phase;

b. identifying the journals at the core of a theme;

c. measuring the coverage of secondary journals;

d. predicting publication trends;

e. studying dispersal and obsolescence of literature;

f. predicting the productivity of individual authors, organizations, and countries;

g. measuring the degree and patterns of collaboration among authors; and,

h. analyzing citation and co-citation processes.

Therefore, this work contends that studies based on the bibliometrics technique focus on contributing to the understanding of the contemporary scenario of production and dissemination of scientific accounting knowledge by considering all subjects involved in this process.

The sample analyzed includes publications from two three-year periods (2007 to 2009; 2010 to 2012) of researchers associated with the Graduate Program in Accounting at Unisinos.

Data collection employed secondary data research, while the time frame was comprised of longitudinal observations. Reviewed papers were obtained from electronic searches conducted in the curriculum lattes of the researchers associated with the program using the Lattes Platform.

Data collected on the publications include the year of publication, article title, author/co-authors, name of the researcher, type of publication (i.e., journals, proceedings, book chapters), title of the journal or conference, and the Qualis score (for periodicals only). After entering the data, names were spellchecked to avoid including different spellings for the same name. Although the incidence of homonyms was not prevented, as pointed out by Silva et al. (2006), name standardization is required to determine co-authorships.

Regarding data analysis, two distinct procedures were used in this study: software for social networking analysis (Ucinet) and descriptive analysis.

Data analysis and presentation

The goal of this chapter is to establish the theoretical and practical relationships of the main themes of the study, including the general and specific perspective of social networks, the performance (in Qualis scores) of the researchers in the sample, as well as the description of the main characteristics of the scientific production of the Graduate Program in Accounting at Unisinos.

Study object and time series of publications

The Graduate Program in Accounting at Unisinos currently has a CAPES evaluation score of five. With a focus on the areas of internal audit and finance, the program has three research areas: accounting for external users, management control, and corporate finance.

Thirteen researchers are associated with the program who have published 605 scientific publications (i.e., articles or abstracts published in journals or conferences, book chapters, books) in the period studied. Table 1 shows the distribution of the publications by type and by the three-year periods.

Table 1 - List of publications distributed by type

Researcher	2007-2009						2010-2012					
	BC	CP	JA	PB	EA	CA	BC	CP	JA	PB	EA	CA
A	0	10	10	2	1	0	0	9	9	5	3	0
B	2	19	10	1	0	0	4	13	24	1	0	0
C	1	0	4	4	0	0	0	4	11	0	0	7
D	0	7	4	0	0	0	0	11	13	3	0	0
E	0	17	12	2	0	0	0	19	18	1	0	0
F	2	7	0	1	0	0	0	0	6	0	0	0
G	3	9	3	1	1	0	1	3	5	0	0	0
H	2	13	7	1	0	0	3	15	11	3	0	0
I	1	3	0	2	0	0	0	5	6	0	0	0
J	1	20	25	2	0	0	4	20	43	0	0	0
K	1	12	5	0	0	0	0	8	3	0	0	0
L	0	10	2	0	0	0	1	6	3	0	0	0
M	4	23	6	0	1	0	9	8	12	0	1	0
Total	**17**	**150**	**88**	**16**	**3**	**0**	**22**	**121**	**164**	**13**	**4**	**7**

Legend: BC–Book Chapters; CP–Conference Proceedings; JA–Journal Articles: PB–Published Books; EA–Conference Expanded Abstracts; CA–Conference Abstracts.
Source: Study Data

Of the 605 articles published over the period researched, 44.79% were published in conference proceedings, followed by 41.65% published in journals.

Articles published in journals were analyzed according to the Qualis score in the area of administration, accounting, and tourism, as shown in Table 2.

Table 2 – Classification of journals

Researcher	2007–2009										2010 – 2012									
	A1	A2	B1	B2	B3	B4	B5	C	NA	Score	A1	A2	B1	B2	B3	B4	B5	C	NA	Score
A	0	0	2	2	0	1	0	0	5	240	0	0	2	1	0	1	1	0	4	200
B	0	0	1	1	3	1	2	0	2	240	0	0	0	2	6	7	2	0	7	440
C	0	0	2	0	0	0	0	0	2	120	0	0	1	1	2	3	0	0	4	230
D	0	0	0	0	0	0	2	0	2	20	0	0	1	0	2	2	1	0	7	170
E	0	0	0	0	2	0	2	0	8	80	0	0	4	1	3	2	0	0	8	420
F	0	0	0	0	0	0	0	0	0	0	0	0	1	2	1	1	0	0	1	210
G	0	1	0	0	2	0	0	0	0	140	0	1	1	0	1	0	0	0	2	170
H	0	0	0	1	1	1	4	0	0	140	0	0	0	0	0	2	4	0	5	80
I	0	0	0	0	0	0	0	0	0	0	0	0	1	2	1	1	1	0	0	220
J	0	0	2	1	6	2	5	0	9	440	0	0	4	2	8	6	3	0	20	730
K	0	0	0	0	2	0	0	0	3	60	0	0	0	0	1	0	0	0	2	30
L	0	0	0	0	0	0	0	0	2	0	0	0	1	1	0	0	0	0	1	110
M	0	0	2	0	0	1	0	0	3	140	0	0	1	1	3	2	1	0	4	250
Total	0	1	9	5	16	6	15	0	36	1620	0	1	17	13	28	27	13	0	65	3260

Note: * NA – Journals not scored by Qualis-CAPES.
Source: Study Data

Profile of relational links in the network

Regarding the relational perspective of the authors (i.e., program researchers and other authors listed in their publications, referred to herein as "others") who published in the period studied (2007–2012), relational links were mapped between the authors. The authors were distributed in a square array with binary observations (0 and 1) according to whether or not relations existed between the main authors in the area. The density of the network was calculated by the ratio of lines on a graph to the maximum possible lines, and ranged from 0 to 1. This measure was chosen to demonstrate the pattern of overall density of the relationship in the proposed period.

Although the data were collected from 2007 to 2012, they are presented in two three-year periods, according to CAPES practice, 2007–2009 and 2010–2012. This separation depicts the evolution of the search field in a temporal series to detect the construction of relationships in the periods defined.

Figure 1 shows the general sociogram for each period. In 2007–2009, 253 authors were identified with a general network density of 0.012 (range 0–1). In 2010–2012, 284 authors were identified with a general network density of 0.012.

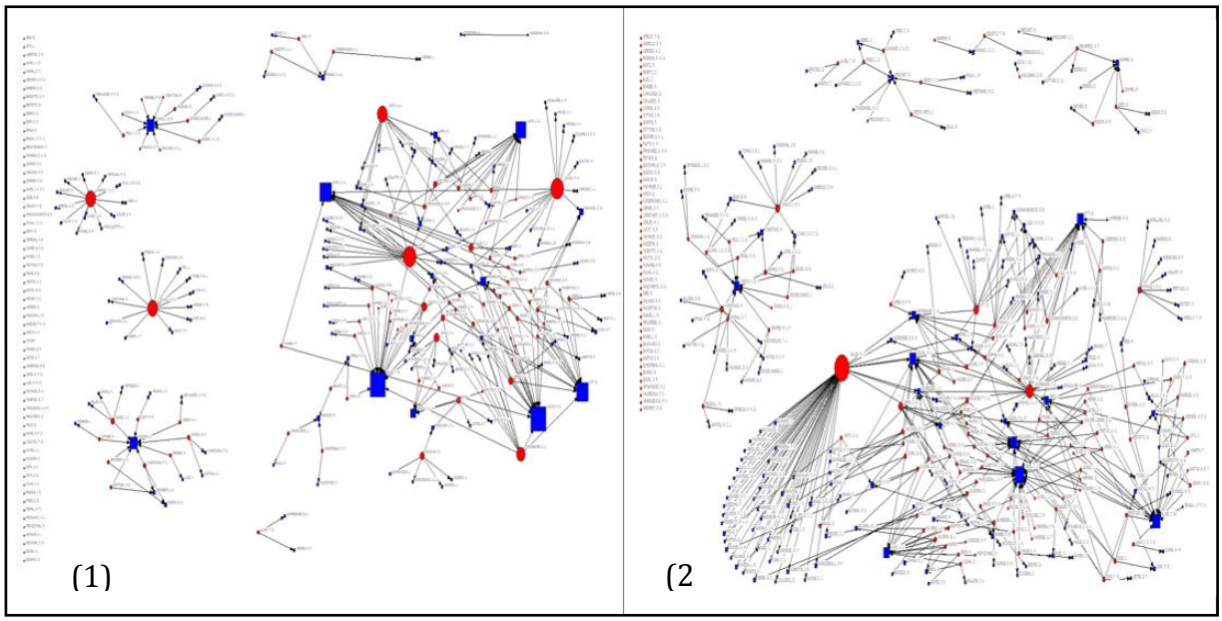

Figure 1 – General network sociograms for 2007–2009 (1) and 2010–2012 (2)
Source: Study Data

Comparing the statistical data from 2007–2009 and 2010–2012, the number of participants increased (from 253 to 284), whereas the network density remained unchanged from one period to the other (0.012).

Table 3 – Comparison of quantitative data

Characteristics	2007–2009	2010–2012
Number of active participants	253	284
General density	0.012	0.012

Source: Study Data

The general density observed (0.012) indicates that the cooperative network of researchers (others) who wrote together with professors associated with the Graduate Program in Accounting at Unisinos displays a weak relationship of ties. This is reinforced by the sociogram in Figure 2, demonstrating the centrality perspective by the author (individual). In this case, the greater the size of the "node," the greater centrality of the author from a relational perspective.

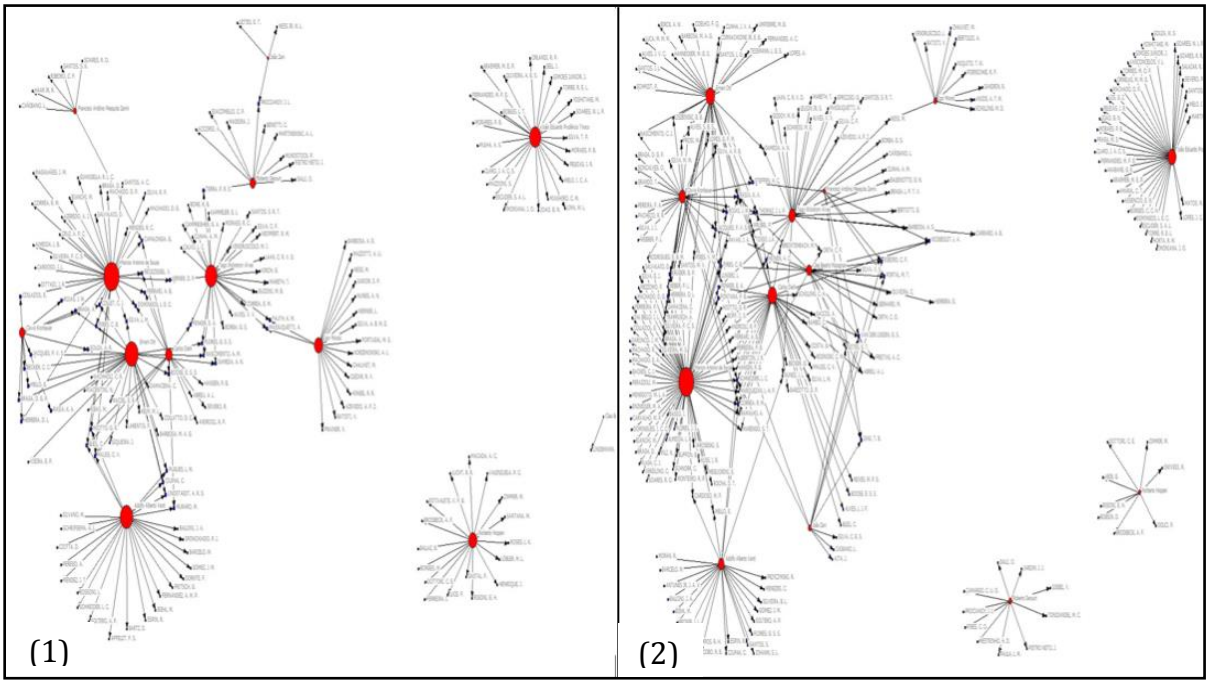

Figure 2 – General network sociograms by centrality, 2007–2009 (1) and 2010–2012 (2)
Source: Study Data

Examining the indicators from the individual perspective of the players, the perception of the centrality by the author suggests the degree of the inter–relationship. In this context, the higher the degree of centrality of an author in the network, the greater their importance in the relational structure between researchers in the area (Table 4). The degree of centrality aims to reveal the number of ties that an actor has with other actors in a network by considering only adjacent relationships, resulting in the local centrality of the actors (ROSSONI; HOCAYEN–DA–SILVA; FERREIRA JUNIOR, 2006, p. two). Lower values represent a more dispersed network in terms of centrality.

Table 4 – Centralization by author in general relationships (researchers associated with the program)

2007–2009			2010–2012		
Author	**Degree Centr.**	**Rank**	**Author**	**Degree Centr.**	**Rank**
E	0.122	1	J	0.263	1
J	0.122	2	B	0.149	2
M	0.109	3	M	0.121	3
G	0.092	4	D	0.118	4
H	0.092	5	E	0.098	5
A	0.092	6	C	0.092	6
B	0.080	7	A	0.086	7
D	0.076	8	H	0.069	8
K	0.052	9	I	0.052	9
F	0.046	10	G	0.043	10
L	0.038	12	L	0.034	12
I	0.031	17	F	0.034	13
C	0.008	93	K	0.029	15

Source: Study Data

Regarding the classification of the main authors according to the degree of centrality, the largest values are linked to the researchers of the program, which is expected considering the importance of some authors, such as researcher "J" (0.122, 0.263) and researcher "M" (0.109, 0.121), who remained in the top three positions during both periods. Compared to the 253 researchers from 2007–2009 and the 284 from 2010–2012, 10 program researchers showed significant degrees of centrality and were in the top ten positions. The degree of centrality by author aims to identify those authors with an authorship or co-authorship relationship with others, without indicating the importance of their scientific output; rather, it reflects the importance of the authors in the establishment of relations with other researchers in the area.

Table 5 – Research network indicators of the Graduate Program in Accounting at Unisinos

2007–2009				2010–2012			
Author	**Degree Centr.**	**Closeness**	**Betweenness**	**Author**	**Degree Centr.**	**Closeness**	**Betweenness**
A	0.092	0.763	0.020	A	0.086	0.600	0.055
B	0.080	0.939	0.049	B	0.149	0.712	0.081
C	0.008	477.000	0.000	C	0.092	0.615	0.034
D	0.076	1.017	0.035	D	0.118	0.809	0.118
E	0.122	1.058	0.070	E	0.098	0.718	0.063
F	0.046	0.905	0.016	F	0.034	0.604	0.005
G	0.092	39.750	0.001	G	0.043	0.388	0.025
H	0.092	39.750	0.001	H	0.069	6.400	0.009
I	0.031	0.663	0.025	I	0.052	0.680	0.034
J	0.122	0.916	0.039	J	0.263	0.756	0.148
K	0.052	14.000	0.004	K	0.029	36.267	0.001
L	0.038	0.477	0.013	L	0.034	30.222	0.001
M	0.109	1.000	0.094	M	0.121	0.737	0.108

Source: Study Data

The indicators observed when considering the actors (researchers) under the integrated perspective of the degree of centrality, betweenness, and closeness are shown in Table 5.

Relationships and Performance

Even though initially descriptive, the time sample of the survey (only two streams) was small. The aim of this section is to investigate an association between the researchers' relationship indicators and their performance, measured in Qualis scores. Table 6 shows the researchers' scores, number of publications, and centrality for each three-year period.

Table 6 – Publication and networks indicators of researchers of the Graduate Program in Accounting at Unisinos (2007–2009/2010–2012).

2007–2009					
Author	**Degree Centr.**	**Closeness**	**Betweenness**	**Publications (number)**	**Score**
A	0.092	0.763	0.020	23	240
B	0.080	0.939	0.049	32	240
C	0.008	477.000	0.000	9	120
D	0.076	1.017	0.035	11	20
E	0.122	1.058	0.070	31	80
F	0.046	0.905	0.016	10	0
G	0.092	39.750	0.001	17	140
H	0.092	39.750	0.001	23	140
I	0.031	0.663	0.025	6	0
J	0.122	0.916	0.039	48	440
K	0.052	14.000	0.004	18	60
L	0.038	0.477	0.013	12	0
M	0.109	1.000	0.094	34	140
2010–2012					
Author	**Degree Centr.**	**Closeness**	**Betweenness**	**Publications (number)**	**Score**
A	0.086	0.600	0.055	26	200
B	0.149	0.712	0.081	42	440
C	0.092	0.615	0.034	22	230
D	0.118	0.809	0.118	27	170
E	0.098	0.718	0.063	38	420
F	0.034	0.604	0.005	6	210
G	0.043	0.388	0.025	9	170
H	0.069	6.400	0.009	32	80
I	0.052	0.680	0.034	11	220
J	0.263	0.756	0.148	67	730
K	0.029	36.267	0.001	11	30
L	0.034	30.222	0.001	10	110
M	0.121	0.737	0.108	30	250

Source: Study Data

For each of the researchers, the historical relationship of the network indicators (degree of centralization, betweenness, and closeness) and the performance variable (score) can be identified as ascending (+) and descending (–) events, as shown in Table 7.

Table 7 – Increase or decrease of network and publication indicators of researchers associated with the Graduate Program in Accounting at Unisinos (2007–2009/2010–2012).

Author	Degree Centr.			Closeness			Betweenness			No. publications			Score		
	07–09	10–12		07–09	10–12		07–09	10–12		07–09	10–12		07–09	10–12	
A	0.092	0.086	–	0.763	0.600	–	0.020	0.055	+	23	26	+	240	200	–
B	0.080	0.149	+	0.939	0.712	–	0.049	0.081	+	32	42	+	240	440	+
C	0.008	0.092	+	477.000	0.615	–	0.000	0.034	+	9	22	+	120	230	+
D	0.076	0.118	+	1.017	0.809	–	0.035	0.118	+	11	27	+	20	170	+
E	0.122	0.098	–	1.058	0.718	–	0.070	0.063	–	31	38	+	80	420	+
F	0.046	0.034	–	0.905	0.604	–	0.016	0.005	–	10	6	–	0	210	+
G	0.092	0.043	–	39.750	0.388	–	0.001	0.025	+	17	9	+	140	170	+
H	0.092	0.069	–	39.750	6.400	–	0.001	0.009	+	23	32	+	140	80	–
I	0.031	0.052	+	0.663	0.680	+	0.025	0.034	+	6	11	+	0	220	+
J	0.122	0.263	+	0.916	0.756	–	0.039	0.148	+	48	67	+	440	730	+
K	0.052	0.029	–	14.000	36.267	+	0.004	0.001	–	18	11	–	60	30	–
L	0.038	0.034	–	0.477	30.222	+	0.013	0.001	–	12	10	–	0	110	+
M	0.109	0.121	+	1.000	0.737	–	0.094	0.108	+	34	30	–	140	250	+

Source: Study Data

Examining each of the actors, a relationship is apparent between the independent (network indicators) and dependent (performance) variables.

Regarding the descriptive classification of the association (associated embeddedness and unassociated embeddedness), as proposed by Cruz (2013), only one of the researchers (I) exhibited fully associated embeddedness, because it is directly related to growth or the decrease of all independent variables and the dependent variable. The other researchers with associated embeddedness (A, B, C, D, G, H, J, K, L, and M) display only a partial relationship between the network indicators and their score. Finally, two researchers (E and F) present no descriptive relationship between the variables, and are categorized as having unassociated embeddedness.

Table 8 – Embeddedness classification

Researcher	DC	C	B	S	P	Variables	Embeddedness
A	–	–	+	+	–	CG – CP = P	Associated Embeddedness
B	+	–	+	+	+	CG + CI = P	Associated Embeddedness
C	+	–	+	+	+	CG + CI = P	Associated Embeddedness
D	+	–	+	+	+	CG + CI = P	Associated Embeddedness
E	–	–	–	+	+	≠	Unassociated Embeddedness
F	–	–	–	–	+	≠	Unassociated Embeddedness
G	–	–	+	+	+	CI = P	Associated Embeddedness
H	–	–	+	+	–	CG – CP = P	Associated Embeddedness
I*	+	+	+	+	+	CG + CP + CI = P	Associated Embeddedness
J	+	–	+	+	+	CG + CI = P	Associated Embeddedness
K	–	+	–	–	–	CG – CI = P	Associated Embeddedness
L	–	+	–	–	+	CP = P	Associated Embeddedness
M	+	–	+	–	+	CG + CI = P	Associated Embeddedness

Legend: DC– degree of centrality; C– closeness; B– betweenness: S– Qualis score; P– number of publications
Source: Study Data

Final considerations

As evidenced in a study of the FURB Master's Program in Accounting (ROCHA et al., 2013) and other databases, the association between the relationship of social actors and their performance has led to intriguing questions, especially regarding the scientific production of researchers in applied social sciences.

In this scenario, bibliometric research of the publications from the Graduate Program in Accounting at Unisinos, the object of this study, as well as of its main relational characteristics reveals that, for most of the researchers, in addition to a considerable publication record, there is an apparent association between their score in each three-year period and their relationship competences, from the perspectives of degree, closeness, and betweenness.

With the exception of two researchers (E and F), the evidence, although limited to being initially descriptive due to the lack of a historical series for statistical analysis, indicates an increase or decrease in performance (score) by the social actors such that their relationships prove more relevant. This suggests that the immersion of the actors (embeddedness) in relational structures is an important element for performance, demonstrating the importance of relationships between researchers and students in the development of new publications.

Finally, it is important to emphasize that the initial question of this article was fully addressed, despite the study's limitations In conclusion, there is qualitatively consistent evidence of the existence of a positive association between the relationship and performance among researchers associated with the Graduate Program in Accounting at Unisinos, as also evidenced for the FURB program (Rock, et al., 2013). Such evidence may be confirmed or refuted quantitatively in the future when analysis is made possible by the availability of a triennial historical series.

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Received: 05/30/2016

Approved: 07/15/2016