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Service's scientific community: a social network analysis (1995-2010)

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Abstract

Purpose – The purpose of this paper is to characterize and discuss the collaborative network formed by researchers that published about services in the top journals in Operations, Marketing, and Human Resources Management, and provide further comparison with major Service journals.

Design/methodology/approach – The method used was designed documentary research using papers published in the top three relevant international journals specific to Operations, Marketing, and Human Resources from 1995 to 2010. Papers were selected using a search of the ABI/Inform Global (Proquest) database on the word "service" in the title, abstract, or keywords. Additionally, it included two major Service journals. A total of 1,481 papers and 2,457 authors composed the Social Network Analysis (SNA).

Findings – The co-authorship network revealed that the social structure is highly fragmented. However, its main component can be classified as "small world", indicating that authors are connected to others outside their group through a small number of intermediaries. This type of structure is favorable both to knowledge flow and development.

Practical implications – The results may be valuable to the community of researchers interested in the theme of Services, as well as in the fields of Operations, Marketing, and Human Resources to identify researchers and research groups. Thus, it can serve as guidance for publishers, colleges, and companies in the search for scholars in the service subject.

Originality/value – The paper uses SNA to investigate the interaction/collaboration of co-authors using authorship as the unit of analysis.

Keywords Services, Social network analysis, Collaborations, Operations, Marketing, Human resources, Human resource management, Social networks

Paper type Research paper

1. Introduction

Based on studies of collaborative networks in sociology, researchers suggest that scientists in collaborative networks share ideas, use similar techniques, and influence each other's work (Newman, 2001, 2004; Moody, 2004). Moody (2004) states that the set of ideas one holds to be true is largely a function of the group of people with whom one interacts, in connection with authorities recognized by the group.

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Co-authorship is a formal way to analyze collaboration in scientific fields. Academics, in general, seek collaboration while conducting and publishing research. Collaboration reduces knowledge isolation and increases the potential to access economic resources and expertise (Acedo *et al.*, 2006; Glanzel and Schubert, 2004).

When analyzing scientific collaboration, authors usually choose between two approaches:

(1) reasons why researchers collaborate; or

(2) analysis of researchers' network structure.

The present research will focus on the second approach, on the argument that the network structure reveals relevant aspects related to a social structure. Besides, it is useful to understand the collaborative path for different levels, such as individuals, institutions, sectors, and countries (Acedo *et al.*, 2006; Glanzel and Schubert, 2004; Barabási and Albert, 1999).

This type of study is especially useful when applied in a scientific field with multiple interfaces. According to Johnston (1999), research related to service themes was re-established within its core disciplines (that is, operations, marketing, and human resources management) after 1995. Consequently, the present research aims to identify the characteristics of the collaborative network between researchers that published around the subject of service in the top specific journals of each discipline after 1995 and to compare them with the two major services journals. Based on 1,481 papers published during this 16-year period (1995-2010), it is analyzed the network structure formed by 3,591 authorship combinations among 2,457 authors by testing statistics relating to the small world concept to verify if the researchers allowed knowledge flow and sharing of ideas. It is also identified the most prolific and most central authors.

2. Theory base

2.1 Scientific collaboration

Study of the complex social phenomenon of scientific collaboration began in a systematic way in 1960 (Glanzel and Schubert, 2004). Scientific papers written by more than one author were relatively rare during the first-half of the twentieth century and, therefore, scientific research was essentially the work of individuals who published research without any type of collaboration. The trend of co-authorship originated with the natural sciences and it still continues to be more associated with this area of knowledge, even though there has been an increase in co-authorship in the social sciences as well (Acedo *et al.*, 2006). As a consequence of this trend, there is an interest among academic researchers in the phenomenon of collaboration between scientists.

Co-authorship is the most formal type of scientific collaboration to analyze. There are some possible reasons for the increase in co-authorship in research, such as the maximization of economic resources (whether direct or indirect), greater access to financial resources and equipment, and intra-scientific factors (especially changing communication patterns and increasing mobility of scientists) which allow greater access to expertise, increase productivity, and reduce the isolation of knowledge (Acedo *et al.*, 2006; Newman, 2004).

The study of researchers' collaborative networks gives an understanding of some of the characteristics of social groups in scientific fields. This analysis allows the

examination of collaborative relationships and the analysis of publication in a sociological perspective. In addition, it can reveal interesting features about academic communities (Barabási and Albert, 1999; Newman, 2001; Moody, 2004).

In a co-authorship network, two or more authors are connected if they have co-authored at least one paper (Newman, 2004). In this type of analysis the networks can reveal much about the social characteristics of the academic structure of knowledge. Investigation of this phenomenon has been possible only with the advent of widespread availability of online bibliographies, starting from year 2000. After that time, several researchers started to build large-scale networks and to represent research in areas such as Math, Biology, Physics, Computer Science, and Neuroscience (Acedo *et al.*, 2006; Newman, 2001, 2004; Moody, 2004).

Co-authorship analysis can also be used at different levels such as individuals, institutions, sectors, and countries. Another variation is analysis of longitudinal data. Barabási and Albert (1999) justify the need for a longitudinal study as co-authorship networks are constantly expanding due to the change of social actors and their association over time.

2.2 Social network analysis

Recent studies have shown the potential of social network analysis in the investigation of scientific collaboration (Barabási and Albert, 1999; Newman, 2001). According to Moody (2004), social network analysis allows the examination of collaborative relationships and publication in a sociological perspective. The author points out that recent work in the sociology of knowledge suggests that the set of ideas that a person holds to be true is largely a function of the group of people with whom he or she interacts and references recognized by the group, which has been shown to operate in small groups.

In the present study the researchers are seen in a network of social interaction in which they share, cooperate, and exchange information and resources, organize themselves in various forms, and create socially accepted parameters for assessment, recognition, or rejection of ideas.

Acedo *et al.* (2006) used social network analysis in a longitudinal study of co-authored articles published in top management journals from 1980 to 2002. Some of their conclusions were:

- there was a progressive increase in the number of articles co-authored in management;
- the characteristics of the network of co-authorship in management were not very different from those observed in certain other disciplines, such as sociology, but they differed from those in natural sciences;
- although there were sub-groups in the network of co-authorship, the most central authors in general were relatively connected to each other; and
- there was a pre-dominance of American authors from a few privileged universities that played an important role in professional associations and publishing of journals.

In this type of analysis, any attempt to explain human behavior or social processes is rejected (Emirbayer and Goodwin, 1994; Scott, 2000; Wasserman and Faust, 1994; Wellman, 1998). Social networks are sets of contacts that connect the various actors

and such contacts can be presented in different types, with different contents and, consequently, different structural properties.

In order to allow a better understanding of the social network analysis and its use in collaborative relationships between researchers, it will be presented the following concepts: density, components, centrality measures, and small worlds.

2.3 Density

Density is a network parameter that expresses the ratio of the number of ties in one group divided by the total number of possible ties between the actors that constitute the network (Knoke and Kuklinski, 1982). This structural indicator varies in an interval [0,1], in which the closer the indicator is to 0, the lower the network's connections, while an indicator closer to 1 means a more highly connected network.

In environments with a high density of relationships, the network's content becomes increasingly redundant (Kogut and Walker, 2001). On the other hand, networks with low density have weak ties. Kuhn (1996) states that new paradigms may be seen as inconsistencies in very cohesive communities of scientists, and interaction with other researchers outside their group is important.

2.4 Components

A network may have many sub-groups. Components are fully connected sub-networks in which all nodes are connected by ties, but no link is made with an actor outside of the component (Wasserman and Faust, 1994; Scott, 2000). Thus, the main component will be the greatest fully connected sub-network.

2.5 Centrality

Centrality is configured as a property that measures how central an actor is in a network. In social network analysis, it is common to identify the most central actors, as centrality relates to the importance of their position in the network. To measure the centrality of the actors, it is used in present research both degree centrality and betweenness centrality (Scott, 2000; Wasserman and Faust, 1994):

(1) *Degree Centrality*. Degree Centrality is the number of ties that an actor has with other actors in a network (Wasserman and Faust, 1994). According to Scott (2000), as degree centrality takes into account only the adjacent relationships, this only shows the local centrality of any given actor.

(2) *Betweenness Centrality*. The interaction between non-adjacent actors might depend on other actors, which may potentially have some control over the interactions between two actors who are not adjacent. In this sense, according to Freeman (1979) and Wasserman and Faust (1994), an actor is an agent if that person binds several other actors that do not connect directly.

2.6 Small worlds

According to Watts and Strogatz (1998), small worlds occur when the actors of a network are grouped sparsely, but at the same time they are connected to actors outside their group through a small number of intermediaries. Theoretically, the concept of small worlds is closer to the analysis of cohesion approach (Coleman, 1990), structural holes (Burt, 1992) or weak ties (Granovetter, 1973). At the same time that there are connections with other groups in which the information is not redundant, there is a level

of cohesion of activities necessary to become familiar among the members (Uzzi and Spiro, 2005). Thus, the properties of a small world produce elements connected to the durability of relationship structures, such as authors and institutions, which are essential to understanding mutual relationship between local and global structures.

3. Methodology

To achieve the stated objectives in this research paper, a descriptive and exploratory study was developed. It was based on documentary research applied to scientific papers published in the top three most relevant journals specific to operations (Barman *et al.*, 2001); marketing (Baumgartner and Pieters, 2003); and human resources management (Caligiuri, 1999). We decided to base our study only in the specific journals of each core discipline in order to address the researcher's specific area in the analysis. However, we also included two major services journals in order to reflect better the service scientific community.

The journals analyzed were:

- *IJOPM – International Journal of Production and Operations Management.*
- *JOM – Journal of Operations Management.*
- *POM – Production and Operations Management.*
- *JM – Journal of Marketing.*
- *JMR – Journal of Marketing Research.*
- *JCR – Journal of Consumer Research.*
- *IJHRM – International Journal of Human Resource Management.*
- *HRM – Human Resource Management.*
- *HRMJ – Human Resource Management Journal.*

It was conducted a search of the ABI/Inform Global (Proquest) database on the word "service" in the titles, abstracts, or keywords of these journals (from 1995 through 2010).

The service journals analyzed were:

- *JOSM – Journal of Service Management* (formerly the *International Journal of Service Industry Management*).
- *JSR – Journal of Service Research.*

For those, it was included all scientific papers published from 1995 to 2010 since they are all related to the theme of services management.

From the selected papers, it was extracted the units of analysis, in this case, each author who, alone or jointly with other authors, published a scientific paper in the period of time being analyzed. In order to understand the evolution of some of the data over time, the total period is divided into three sub-periods (1995-2000; 2001-2005; 2006-2010). Ucinet 6.0 (Borgatti *et al.*, 2002) was used to design the network and to analyze network statistics.

3.1 Data and sample

Our search found 379 papers about service published in operations journals (*POM*, *JOM*, *IJOPM*), 193 in marketing journals (*JM*, *JMR*, *JCR*), and 182 in human resource journals (*IJHRM*, *HRMJ*, *HRM*). As shown in Table I, they, respectively, represent

Journals (primary focus)	Amount of journals		Period 1 (1995-2000)	Period 2 (2001-2005)	Period 3 (2006-2010)	Total (1995-2010)
Operations	3	Service	88	119	172	379
		Overall	745	865	837	2,447
		%	11.81	13.76	20.55	15.49
Marketing	3	Service	60	61	72	193
		Overall	1,012	982	922	2,764
		%	5.93	6.21	7.81	6.98
Human resources	3	Service	28	35	119	182
		Overall	848	580	961	1,964
		%	3.30	6.03	12.38	9.27

Table I.
Scientific production in the subject of service (disciplinary journals)

Source: Research results

15.49, 6.98, and 9.27 percent of total publications in each discipline. Dividing the analysis period into thirds, one can perceive that there was an increase in the publication of service papers as part of the overall production in the disciplines of operations and marketing. In human resources, there is an increase in the third period when compared to the previous two due to the impact of *IJHRM*, which started publication after 2004, with higher rates after 2005.

Comparing the production of services-related papers in the disciplinary journals (operations, marketing and human resources) with multidisciplinary journals (Service – *JOSM*, *JSR*), in Table II, it is concluded that whereas there is an increase by 22 percent in period 2 in the disciplinary journals, there is an increase of 24 percent in the same period in service journals, which is related to the contribution of the *Journal of Service Research*, which started publishing in 1998. However, in period 3 there is an increase of 5 percent in services journals and of 68 percent in the disciplinary journals, with 47.3 percent of them published in operations related journals.

An author is credited with authorship for each paper on which his or her name appears during the 16-year period in the journals selected. By the same token, the number of authorships one paper has is the number of authors collaborating in its publication. So, it can be noted in Table III that in the total 753 papers selected in the disciplinary journals (*OPS*, *MKT* and *HR*), a total of 1,429 authors are involved in the publication. This is an average of almost two co-authors of each paper. If that were the real pattern of collaboration it would be expected to find a similar proportion of authorships per paper. However, the data presents a proportion higher than 2, what indicates that the amount of papers with more than two co-authors was higher than the number of papers with only

Journals (primary focus)	Amount of journals		Period 1 (1995-2000)	Period 2 (2001-2005)	Period 3 (2006-2010)	Total (1995-2010)
Disciplinary (*OPS*, *MKT*, *HRM*)	9	Service	176	215	363	753
Multidisciplinary (service)	2	Overall	205	255	268	728

Table II.
Scientific production in the subject of service

Source: Research results

one author. In fact, 43.7 percent of papers had more than two co-authors, while only 15.8 percent had one author. In short, 84.19 percent of papers represented a collaborative relationship between at least two researchers.

The same reasoning can be applied to the service journals and to the total database, which is composed by disciplinary and multidisciplinary journals (last two columns in Table III). In the case of services journals, 79.12 percent of papers presented collaboration, while in the total database, 81.63 percent of papers involved a co-authorship relationship. Looking at the number of authors constituting disciplinary or multidisciplinary journals and the total database, it can be inferred that a total of 174 authors contributed both to disciplinary and to multidisciplinary journals, since that is the difference between the number of researchers in total database and the sum of the other two.

At the end, 50 percent of papers in database originated from the disciplinary journals, and 50 percent of the papers in the disciplinary database were published in operations journals. Comparing Tables I-III one must note a discrepancy in the number of papers published in operations because of Johnston's paper "Service operations management: return to roots," which was published in 1999 and re-published in 2005.

Table IV shows the most prolific authors in the disciplinary and multidisciplinary journals. It can be noted that among the most prolific authors in the disciplinary journals, there is a pre-dominance of authors that published in operations, as compared to the other two disciplines and also there is a pre-dominance of authors publishing in just one discipline, with two exceptions that published in operations and marketing journals. By comparing disciplinary and multidisciplinary journals, one can also see that one author (Robert Johnston) appears as most prolific in both.

4. Researchers' collaborative network

Analyzing the evolution of scientific production and its relationships (Table V), the rate of growth in the number of researchers was higher than the rate of growth in the number of published articles (by contrasting periods 2 and 1, 3 and 2, and 3 and 1), which indicates more collaboration between authors over time. In addition, there was a decrease in the percentage of authors publishing solo articles.

It can also be inferred from Table V that over the period studied the authors sought new partnerships for the development of articles, as the average number of ties (or authorships) per author increased. However, this increase was lower than the rate of entry of authors in the field. This phenomenon is reflected in the density of the ties among the authors, which decreased from period 1 to period 3.

Considering the density level it can be noted that the network studied here is fragmented, as less than 1 percent of the potential and possible ties are really used. However, the decline in density noticed over the analysis period is not unusual given the increasing level of participants involved in the community over the years.

	OPS	MKT	HRM	Sub-total	SVS	Total
Papers	378	193	182	753	728	1,481
Authors	682	394	371	1,429	1,202	2,457
Authorships	904	510	427	1,841	1,750	3,591

Source: Research results

Table III. Authorships in services-related papers (1995-2010)

Reseachers	HRM	MKT	OPS	Total	Researchers	SVS
Boyer, Kenneth	–	–	8	8	Ruyter, Ko	22
Roth, Aleda	–	–	8	8	Wirtz, Jochen	19
Hill, Arthur	–	1	6	7	Mattila, Anna	18
Johnston, Robert	–	–	7	7	Edvardsson, Bo	13
Metters, Richard	–	–	7	7	Johnston, Robert	12
Verma, Rohit	–	–	7	7	Wetzels, Martin	12
Apte, Uday	–	–	6	6	Gustafsson, Anders	11
Hays, Julie	–	1	5	6	Roos, Inger	10
Youngdahl, William	–	–	6	6	Brown, Stephen	9
Bach, Stephen	5	–	–	5	Andreassen, Tor	8
Chase, Richard	–	–	5	5	Gwinner, Kevin	8
Field, Joy	–	–	5	5	Lemon, Katherine	8
Menor, Larry	–	–	5	5	Danaher, Peter	7
Mittal, Vikas	–	5	–	5	Patterson, Paul	7
Nie, Winter	–	–	5	5	Rust, Roland	7
Rabinovich, Elliot	–	–	5	5	Verhoef, Peter	7
Sampson, Scott	–	–	5	5	Gremler, Dwayne	6
Singh, Jagdip	–	5	–	5	Kimes, Sheryl	6
					Lemmink, Jos	6
					Lievens, Annouk	6
					Rosenbaum, Mark	6

Table IV.
Most prolific authors (1995-2010)

Source: Research results

	Period 1 (1995-2000)	Period 2 (2001-2005)	Period 3 (2006-2010)	Total (1995-2010)
Number of papers	381	470	631	1,481
Number of researchers	635	863	1,356	2,457
Average number of ties per author	1.833	2.185	2.516	2.55
Density (%)	0.29	0.25	0.19	0.1
Number of components	179	214	345	515
Number of researchers in the main component	26	61	174	697
Number of isolated researchers	63	63	58	141

Table V.
Descriptive statistics of the scientific production network

Source: Research results

Another indicator of fragmentation can be found by analyzing the components. While there were 179 fully connected sub-networks in period 1, there were 345 in period 3, which recorded an increase of 92 percent in the number of sub-networks. Despite such fragmentation, one can observe that the percentage of authors in the greatest fully connected sub-network (or the main component) increases if compared period 1 (4.1 percent) to period 3 (12.8 percent), which indicates a higher concentration of researchers in the main component over time. It results that in the overall network there are 28.36 percent of total authors connected in the main component.

Comparing the results found in the service network with the ones found in another studies and in different fields (Table VI), it can be inferred that the average number of ties per author in the service network is closer to that of the business and sociology

networks than to that of medicine, physics and math. Given that service is a theme within the business literature, its main component was expected to present a lower percentage of the total researchers when compared to the percentage found in the main component of the business network.

Noting this core sub-network, it is investigated whether this main component could be categorized as a small world. If so, it would indicate that besides being a highly sparse community, this component is also connected to actors outside their group through a small number of intermediaries. Such a characteristic would indicate that there is an access to knowledge flow and ideas sharing inside and outside the main component, even though it can be categorized as more fragmented than the others that have already been studied.

According to Watts and Strogatz (1998), small world networks provide a lower average distance between actors than is found in random networks, while the clustering coefficient should be higher. For a network to be considered a small world it is necessary to evaluate two network properties: average distance (L – length) and clustering coefficient (CC – clustering coefficient).

The average distance (L) is the length of the shortest path that connects an actor to all others in the network, which is calculated for all pairs of actors. High L values indicate that resources, such as information, must pass by a large number of intermediaries to travel between actors in the network.

The clustering coefficient (CC) is the number of connections between the immediate neighbors of a researcher, compared to the maximum number of ties they may have. Evidence suggests that in social networks, nodes tend to create tightly knit groups characterized by a relatively high density of ties (Watts and Strogatz, 1998). The CC can vary from zero (completely ungrouped local networks) to one (fully clustered networks).

An empirical test of whether a network is a small world is to compare both parameters (observed and expected) to the actual network and to a random network with the same number of researchers. In random networks, $L_{exp.} = Ln\ (n)/ln\ (k)$ and $CC_{exp} = K/n$, where L_{exp} is the expected average distance, n is the number of nodes (researchers) in the network and k is the average network actors (Watts, 1999). For a network to have a small world setting, the average distance observed should be similar to the one in a random network ($L_{obs.} \sim L_{exp.}$), while the clustering coefficient of the observed network should be much higher than the value of the random network ($CC_{obs.} \gg CC_{exp.}$). Based on Kogut and Walker (2001) and Davis *et al.* (2003), it is used the following summary statistics to indicate the presence or absence of a small world: SWQ – small world coefficient) = $(CC_{obs.}/CC_{exp.})/(L_{obs.}/L_{exp.})$. The network is considered a small world when SWQ is much larger than one (SWQ $\gg$ 1) (Davis *et al.*, 2003).

	Services[a]	Business[b]	Medicine[c]	Physics[d]	Math[d]	Sociology[e]
Period	1995-2010	1980-2002	1995-1999	1995-1999	1995-1999	1963-1999
Number of researchers	2,457	10,176	1,520,251	52,909	253,339	197,976
Average number of ties per author	2.55	2.86	16.93	9.27	3.90	1.88
Percentage of researchers in the main component	28.4	45.4	92.6	85.4	82.0	34.5

Sources: [a]Research results, [b]Acedo *et al.* (2006), [c]Newman (2001), [d]Newman (2004) and [e]Moody (2004)

Table VI.
Comparison to studies in different fields

Table VII presents the results of this test. The network presented a high clustering coefficient (CC) – one that was higher than the ratio expected for a random network. This indicates the presence of cohesive clusters of researchers. However, the average distance (L) between individuals was higher than expected. Individuals are more distant from each other than expected in a random network. Even with this greater distance, the SWQ was significant to indicate small world (SWQ $\gg 1$), SWQ = 80.71. Greater group cohesion compensated for the greater distance between the researchers. Thus, in the observed network, the main component can be considered a small world.

Table VIII shows the authors who presented the highest levels of centrality in the service community of researchers that published in the selected journals. While the degree of centrality measures the number of co-authorships a given researcher had had in the last 16 years, the betweenness centrality measures the power that researchers had to intermediate or to connect subnets of service authors. On one hand, whereas one can identify central authors that were presented as the most prolific authors (in Table IV) in the disciplinary journals (such as Vikas Mittal, Rohit Verma, Richard Chase and Robert Johnston), one can also verify that some authors were presented as most prolific in the multidisciplinary journals (such as Peter Verhoef, Katherine Lemon, Roland Rust, Robert Johnston, Ko de Ruyter, Bo Edvardsson, Jochen Wirtz, Stephen Brown and Sheryl Kimes).

On the other hand, when considering the number of authors in the overall's network main component (i.e. 697), we found 62 percent more authors in this social interaction than if added together the number of authors in the main components of the disciplinary and multidisciplinary journals (i.e. 429). That suggests that the overall is formed not only by the two main components, since there are relationships in authorships between their members, but also by other actors' relationships that were not connected by its correspondent's main component.

Once identifying the most central authors in the disciplinary journals (Table IX) and drawing the authorship relationships of its main component (Figure 1), it can be perceived that the main component accounts for the majority of most prolific authors (Table IV), which means that researchers most able to contribute to the publication

	Variables	Values
Observable data		
Density		6.3%
Authors	n	697
Average number of ties per author	k	4.24
L_{obs}: average distance	l	7.19
CC_{obs}: clustering coefficient	CC	0.77
Random data (*Watts and Strogatz, 1998*)		
$L_{exp.}$: expected average distance	ln(n)/ln(k)	4.53
$CC_{exp.}$: expected clustering coefficient	k/n	0.006
Indicators		
L_{rate}	L_{obs}/L_{exp}	1.59
CC_{rate}	CC_{obs}/CC_{exp}	128.33
SWQ	CC_{rate}/L_{rate}	80.71

Table VII.
Small worlds statistics

Source: Research results

Researcher	Degree centrality	Researcher	Betweenness centrality
Mittal, Vikas	28	Chase, Richard	65,130
Ruyter, Ko	28	Mittal, Vikas	59,711
Kumar, V.	27	Bowen, David	58,820
Verhoef, Peter	26	Kwortnik, Robert	45,889
Lemon, Katherine	23	Ross J.R., William	45,868
Bolton, Ruth	22	Thompson, Gary	45,543
Rust, Roland	22	Rust, Roland	42,916
Johnston, Robert	21	Lemon, Katherine	41,795
Brown, Stephen	20	Johnston, Robert	41,764
Edvardsson, Bo	18	Danaher, Peter	36,823
Chase, Richard	18	Kimes, Sheryl	33,672
Wirtz, Jochen	17	Meuter, Matthew	30,132
Keiningham, Timothy	16	Zeithaml, Valarie	29,587
Parasuraman, A	16	Verhoef, Peter	29,219
Verma, Rohit	16	Michel, Stefan	28,948
Aksoy, Lerzan	15	Verma, Rohit	27,562
Johnson, Michael	15	Bitner, Mary	27,552
Hennig-Thurau, Thorsten	15	Mattsson, Jan	27,504
Bowman, Douglas	14	Bolton, Ruth	26,679
Libai, Barak	14	Voss, Christopher	24,661
Blazevic, Vera	14	Ruyter, Ko	21,057
Bitner, Mary	14	Froehle, Craig	19,923
Rabinovich, Elliot	14	Edvardsson, Bo	19,883
Voss, Christopher	14	Libai, Barak	18,501

Source: Research results

Table VIII.
Author's centrality (services and disciplinary journals)

Researcher	Degree centrality	Researcher	Betweenness centrality
Verma, Rohit	10	Roth, Aleda	4,294
Mittal, Vikas	10	Chase, Richard	3,668
Hill, Arthur	9	Voss, Christopher	3,002
Alba, Joseph	9	Sousa, Rui	2,496
Zhao, Xiande	9	Boyer, Kenneth	2,456
Fornell, Claes	9	Froehle, Craig	2,389
Apte, Uday	9	Yeung, Andy	1,845
Chase, Richard	9	Zhao, Xiande	1,640
Johnson, Michael	9	Apte, Uday	1,445
Metters, Richard	8	Calantone, Roger	1,198
Goodale, John	8	Dasu, Sriram	1,071
Lynch, John	8	Rao, Jay	960
Kamakura, Wagner	8	Bowen, David	909
Bowen, David	8	Hui, Michael	857
Johnston, Robert	8	Verma, Rohit	824
Sethi, Suresh	8	Metters, Richard	737
Cheng, T.	8	Cheng, T.	668
Boyer, Kenneth	8	Johnston, Robert	622
Youngdahl, William	8	Youngdahl, William	514

Source: Research results

Table IX.
Author's centrality (disciplinary journals)

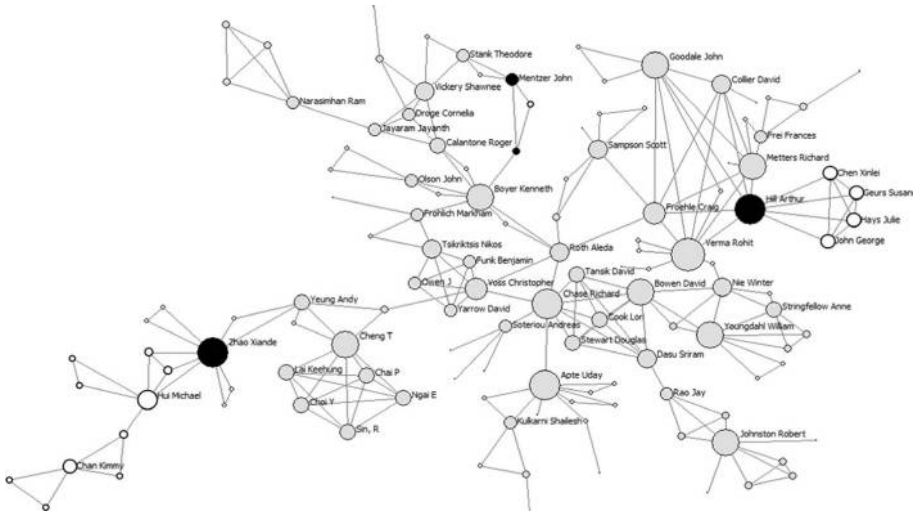


Figure 1.
The main component of disciplinary network

Notes: (a) Ball's size indicates degree centrality, being the larger balls the most central authors; (b) ball's color indicates the area that each author has published: the gray balls represent operations journals, the white marketing journals and the black ones represent authors that published both in operations and marketing journals

of service subjects in the disciplinary journals were also highly interconnected and therefore not so distant from each other in terms of authorships, being central in the most integrated sub-network.

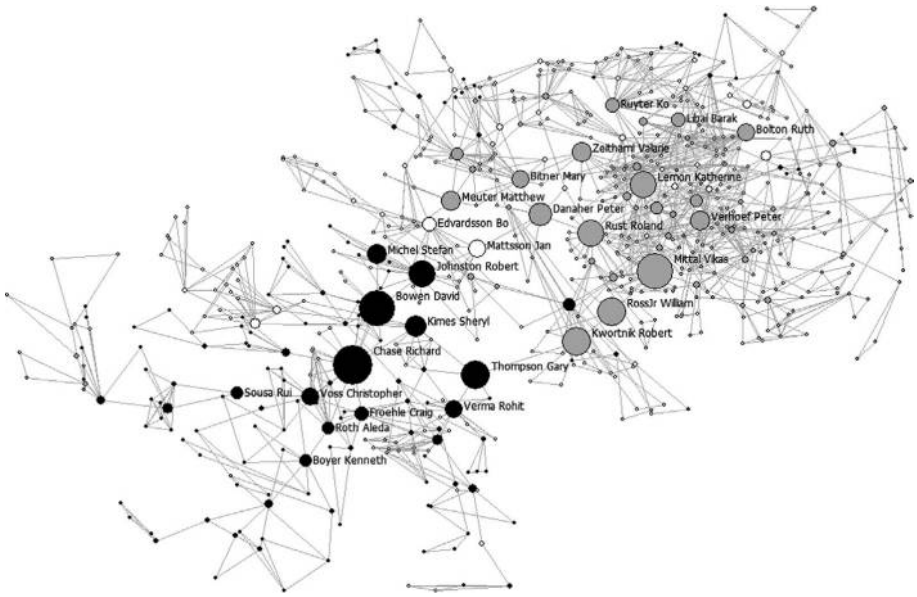
By adding the two networks – disciplinary and multidisciplinary journals – together, by drawing its main components' network (Figure 2) and by comparing the results of Table IX and Figure 1, it can be noted that the five authors with a higher betweenness degree in Table VIII also have higher betweenness degrees in Table IX, which means that they bind several other authors that do not connect directly, and therefore they strongly influence the interaction in this network. They are Christopher Voss, David Bowen, Richard Chase, Robert Johnston and Rohit Verma. The last three also have high degree centrality in the disciplinary journals and they are among the most prolific authors.

5. Conclusions and recommendations

The first contribution of the present study relies on the identification of papers related to the service subject in the top three most relevant journals of operations, marketing and human resources management from 1995 to 2010 and further making a comparison in terms of:

- volume of publications in the theme with overall publications; and
- the increase of service publications over time.

Operations journals accounted for the higher absolute (379) and relative (15.49 percent) values in publishing about services when compared to marketing (193 services



Notes: (a) Ball's size indicatesbetweenness centrality (i.e. the number of shortestpaths from all authors to all others that pass through that node), being the larger balls the most central authors; (b) ball's color indicates the area that each author has published: the black balls represents authors that published at least one paper in operations journals; the gray balls represent authors that published at least one paper in marketing journals and the white ones represent authors that did not publish in the operations and marketing journals selected by our research

Figure 2.
The main component of overall network

papers, represented by 6.98 percent of overall publications) and human resources (182 and 9.27 percent, respectively). In addition, it can be concluded that there was an increase in the publication of service-related articles in the journals covering the three disciplines. The most prolific authors were associated more with operations journals than with the other two disciplines.

Even though the total period studied accounted for more papers published in disciplinary journals than in services journals (which have a more multidisciplinary focus), this trend is only perceived in the period from 2006 to 2010 and not before. Considering that disciplinary journals have limited capacity of publication in different subjects but in one management field, one can perceive the increase relevance of services in the disciplines over time, which bypasses the amount of publications in journals dedicated to the subject. For instance, the total database accounted for 631 papers in the last period studied, with 57.5 percent of them related to the disciplinary journals, a result that can indicate services publication returning to the core disciplines of operations, marketing and human resources, as discussed in Johnston (1999).

The authorship network between authors revealed that the social structure is highly fragmented. For instance, comparing the results found in the service network with the ones found in other studies and in those covering different fields, such as business

administration, medicine, physics, math and sociology, the service network had a lower rate of researchers in the main component, being the most fragmented network compared to the others.

However, further investigation of the main component also revealed that it can be considered a small world, which indicates that besides being a sparse community, it is also connected to actors outside their group through a small number of intermediaries. Such characteristic configurations mean that there is an access to knowledge flow and a sharing of ideas inside and outside of the main component.

Contrasting the networks composed by disciplinary and multidisciplinary journals with their combined network, one can perceive that the combined network's main component consisted of 62 percent more authors than if components of the disciplinary and multidisciplinary journals were added together. That result suggests that authors are connected in a social structure that favors dissemination of ideas and in which knowledge isolation is diminished once analysis is conducted in an integrated fashion.

Finally, after investigating structural characteristics of social groups, it is identified that some of the most central authors in the network were also among the most prolific either in the disciplinary or in the multidisciplinary journals. Additionally, by relating authors' centrality in the overall network with the fields that they published in the network formed by disciplinary journals it was possible to understand how authors, management areas, and components were connected in the service community of researchers.

Our results depict the co-authorship relationships between researchers who have published in top major journals of operations, marketing, human resources and services management, in the period from 1995 to 2010 and that were identified by ABI/Inform Proquest. So, authors and papers that published in other journals or other periods were not included in our analysis. Likewise, a paper was left out if was published without mentioning the word "service" in the title, abstract, or keywords. Furthermore, future research could consider other informal types of relationships between academics as well as relationships between authors in terms of services themes.

References

Acedo, F.J., Barroso, C., Casanueva, C. and Galan, J.L. (2006), "Co-authorship in management and organizational studies: an empirical and network analysis", *Journal of Management Studies*, Vol. 43 No. 5, pp. 957-83.

Barabási, A. and Albert, R. (1999), "Emergence of scaling in random networks", *Science*, Vol. 286 No. 5439, pp. 509-12.

Barman, S., Hanna, M.d. and Laforge, R.L. (2001), "Perceived relevance and quality of POM journals: a decade later", *Journal of Operations Management*, Vol. 19 No. 3, pp. 367-85.

Baumgartner, H. and Pieters, R. (2003), "The structural influence of marketing journals: a citation analysis of the discipline and its subareas over time", *Journal of Marketing*, Vol. 67 No. 2, pp. 123-39.

Borgatti, S.P., Everett, M.G. and Freeman, L.C. (2002), *Ucinet for Windows: Software for Social Network Analysis*, Analytic Technologies, Harvard, MA.

Burt, R.S. (1992), *Structural Holes: The Social Structure of Competition*, Harvard University Press, Cambridge.

Caligiuri, P.M. (1999), "The ranking of scholarly journals in international human resource management", *The International Journal of Human Resource Management*, Vol. 10 No. 3, pp. 515-19.

Coleman, J. (1990), *Foundations of Social Theory*, University of Chicago Press, Chicago, IL.

Emirbayer, M. and Goodwin, J. (1994), "Network analysis, culture and the problem of agency", *American Journal of Sociology*, Vol. 99 No. 6, pp. 1411-54.

Freeman, L.C. (1979), "Centrality in social networks: conceptual clarification", *Social Networks*, Vol. 1 No. 3, pp. 215-39.

Glanzel, W. and Schubert, A. (2004), "Analyzing scientific networks thorough co-authorship", in Moed, H.F. (Ed.), *Handbook of Quantitative Science and Technology Research*, Kluwer Academic Publishers, Dordrecht, pp. 257-76.

Granovetter, M.S. (1973), "The strength of weak ties", *American Journal of Sociology*, Vol. 78 No. 6, pp. 1361-80.

Johnston, R. (1999), "Service operations management: return to roots", *International Journal of Operations & Production Management*, Vol. 19 No. 2, pp. 104-24.

Knoke, D. and Kuklinski, J.H. (1982), *Network Analysis*, Sage, Beverly Hills, CA.

Kogut, B. and Walker, G. (2001), "The small world of Germany and the durability of national networks", *American Sociological Review*, Vol. 66 No. 33, pp. 317-35.

Kuhn, T.S. (1996), *The Structure of Structure Revolution*, 3rd., University of Chicago Press, Chicago, IL.

Moody, J. (2004), "The structure of a social science collaboration network: disciplinary cohesion from 1963 to 1999", *American Sociological Review*, Vol. 69 No. 2, pp. 213-38.

Newman, M.E.J. (2001), "The structure of scientific collaboration networks", *Proceedings of the National Academy of Sciences of the United States of America*, Vol. 98, pp. 404-9.

Newman, M.E.J. (2004), "Coauthorship networks and patterns of scientific collaboration", *Proceedings of the National Academy of Sciences of the United States of America*, Vol. 101, pp. 5200-5.

Scott, J. (2000), *Social Network Analysis: A Handbook*, 2nd ed., Sage, London.

Uzzi, B. and Spiro, J. (2005), "Collaboration and creativity: the small world problem", *American Journal of Sociology*, Vol. 111 No. 2, pp. 447-504.

Wasserman, S. and Faust, K. (1994), *Social Network Analysis: Methods and Applications*, Cambridge University Press, Cambridge, MA.

Watts, D.J. and Strogatz, S.H. (1998), "Collective dynamics of 'small-world' networks", *Nature*, Vol. 393, pp. 440-2.

Wellman, B. (1998), "Structural analysis: from method and metaphor to theory and substance", in Wellman, B. and Berkowitz, S.D. (Eds), *Social Structures: A Network Approach*, Cambridge University Press, Cambridge, pp. 19-61.

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