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DO ORGANIZATIONAL NETWORK STUDIES CONSTITUTE A COHESIVE COMMUNICATIVE FIELD? MAPPING THE CITATION CONTEXT OF ORGANIZATIONAL NETWORK RESEARCH*

The metaphor of "network" is one of the key memes in the social sciences and an important concept to understand contemporary business and society. The growing influence of information technology on everyday- and business life, the turn of innovation and economic policy towards collaborative activities as a catalyst of economic development, and the interest in the "ecosystem" approach to the economy are attracting organization researchers from various fields toward the same set of network concepts. Do these studies of inter- and intra-organizational network formations have a substantial knowledge base for sharing ideas? The present article is concerned with the question whether organization research with a focus on relationships and relationship structures among agents of different levels constitutes a cohesive interdisciplinary field. By utilizing bibliometric data of 80 000 articles (social science research articles of the past three years) and network analytic techniques on a subset of 4000 related articles in this research we show that the network metaphor provides a substantial basis for a common discursive platform.

Keywords: *organizational networks, network analysis, citation analysis, scientometrics, science studies, invisible colleges.*

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ФОРМИРУЮТ ЛИ ИССЛЕДОВАНИЯ ОРГАНИЗАЦИОННЫХ СЕТЕЙ ЕДИНОЕ КОММУНИКАЦИОННОЕ ПОЛЕ? КАРТИРОВАНИЕ КОНТЕКСТА ЦИТИРОВАНИЯ В ИССЛЕДОВАНИЯХ ОРГАНИЗАЦИОННЫХ СЕТЕЙ

Метафора сети является одним из ключевых мемов современных социальных наук и одновременно важнейшей категорией, позволяющей понять

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современные общественные и бизнес-структуры. Растущее влияние информационных технологий на повседневную и деловую жизнь людей, поворот инновационной и экономической политики к новым формам сотрудничества, выступающим катализатором экономического развития, повышающийся интерес к экосистемному подходу в экономике, — все это заставляет исследователей, представляющих различные дисциплины, сконцентрироваться на одном и том же наборе концепций, организованных вокруг понятия сети. Но есть ли у всех этих исследований внутри- и межорганизационных форм взаимодействия достаточная знаниевая база, которая позволила бы ученым включаться в общий дискурс и обмениваться идеями? Данная статья посвящена вопросу, формируют ли исследования организационных сетей, фокусирующиеся на изучении связей и структур связей между разноуровневыми агентами, единое и поступательно развивающееся междисциплинарное поле. Опираясь на библиометрические данные о 80 000 статей (это публикации по социальным наукам, вышедшие в свет в последние три года) и данные эмпирического исследования, осуществленного с использованием техник сетевого анализа на выборке в 4000 текстов, мы демонстрируем, что метафора сети действительно обеспечивает содержательную базу для возникновения общей дискурсивной платформы.

Ключевые слова: *организационные сети, сетевой анализ, анализ цитат, наукометрия, исследования науки, невидимые колледжи.*

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Introduction

There is a distinct approach to economic institutional systems, which focuses on the relationships between organizations and other economic actors at different levels analysing the resulting synergies and negative consequences of these networks. This perspective is engendered by many factors: internal developments in the social sciences, like the appearance of sophisticated network analytic techniques and the growing number of interdisciplinary research teams; the challenges of globalization manifested as the coordination problems of multinational companies, and growing competition, which urge for innovation and other solutions the intellectuals of the western hemisphere are offering as an answer; and finally it is engendered by the new opportunities the communication technologies are making available. The network approach offers an alternative perspective for mainstream economics by shedding light on new phenomena, and possibly offering an organizing framework for this new knowledge.

A particularly important area of economic networks research is organizational network studies (ONS), which have various roots. Transaction costs economics is one of these influential theories, strongly connected to the traditional economic thinking. It views networks or interorganizational relationships, as the optimal form of governance structure under certain circumstances when neither hierarchy, nor the market are

efficient (Williamson 1991: 269; Parmigiani & Rivera-Santos 2011: 1108). The concept of industry clusters (Porter 1990), the geographically bounded networks of companies with high innovational potency, is another important idea that also strongly influences economic policy making. Originated mainly in sociology and anthropology, social network analysis is another prominent field with many relevant lines of research. Apart from its inspirational methodology for relational structures (Wasserman & Faust 1994) historical studies (Pagett & McLean 2006: 1463; Erikson & Bearman 2006: 195), the highly cited concepts of weak ties (Granovetter 1973: 1360) and structural holes (Burt, 1992), and the extensive study of interlocking directorates and ownership structures (Stark & Vedres 2006: 1367), to name just a few concepts and lines of research, are important contributions from social network analysis to the field of ONS. These ideas are synthesized into the notion of network governance which has had many formulations since the nineties (Jones et al. 1997: 911).

As we shift from economics to economic sociology, the focus moves from the structure of business transactions to diverse ties between heteronomous actors of the institutional environment and finally to the cultural factors, norms and values. This whole spectrum of phenomena is relevant for ONS. As Granovetter proposed (1985: 481) more than thirty years ago in his programmatic article for new economic sociology, the economic organization is embedded into social structures and it co-evolves with culture and society. This perspective gains its significance from the heterogeneity of cultural environments in which the economies operate (Fukuyama 1995; Putnam 1993) and has its origins in institutional economics and anthropology.

One can identify very different sources and intellectual incentives behind the growth of organizational network studies, and it is questionable if such a heterogeneous field as organizational network studies is able to form a cohesive communication field and a coherent knowledge core, which could be a foundation for a specific approach to socio-economic life with a professional identity and power. The goal of the present article is to check this and to examine the morphology of the resulting discourse of organization network studies by utilizing bibliographical measures.

Further, we will situate ONS as a research field among the relevant disciplines. First, we argue that in line with these, ONS is one of the points of gravity in the social sciences attracting and organizing knowledge production. Following this conceptual section we introduce a comparative research design which involves three other research fields at different levels of scientific discourse. After that we will compare the integrity of the fields. Then we will try to take a snapshot of the knowledge core of ONS by analyzing the highly cited articles and books as well as the frequently publishing journals in this field. Finally, we present and analyze the journal-to-journal citation network of ONS. These analyses shed light on the topical focuses of ONS, its penetratedness by and importance for different disciplinary fields.

The integrity of social science research fields

Many approaches regarding the organizational structure of knowledge production exist in the social sciences and the sciences. Most authors on the foundational level see invisible colleges emerge, which provide the required social resources, like reputational

structures and informal networks, and the knowledge creating mechanisms, like the different venues of information sharing and collaboration for the reproduction and the development of a given field (Zuccala 2006: 152). On a more general level, one can identify specializations (sometimes equated with invisible colleges) and disciplines. From an epistemological perspective instead of these networks or modules one can see different modes of cognition (Knorr-Cetina 1999) like the cleavage between quantitative and qualitative enquiry in the social sciences. In the case of the social sciences it is also reasonable to assume that transitory bursts of some sort of fashion waves are also important factors of knowledge production as cognitive frameworks (Baskerville & Myers 2009: 647).

Research that is aiming to deal with the knowledge production in scientific disciplines or aiming to characterize a specific field of research — like the present article — has to reflect on this multiplicity of organizational structures. We consider these organizational factors as points of gravity that are pulling the attention of researchers, and that produce overlapping groups of researchers or epistemic communities, not necessary bounded with social ties. Organizational network studies can be such a gravity point.

If we think in terms of multiplicity of issues, approaches, and cognitive frameworks, as a field of forces, instead of discrete modules of science, then we have to question magnitude strength of these points of gravity. Different specialties or trends can have different influence on scientific discourse. This is one reason to measure whether the field we are interested in — namely organizational network studies — is cohesive and can be regarded as an important field of research. In order to assess this we propose a comparative framework, and situate organizational network studies in a context of different fields and disciplines.

However there are two other reasons to use such a research framework. The second reason, which is also connected to the problem of the organization of scientific discourse, is that social science disciplines are constantly reflecting the integrity of their knowledge core. This is problematic, not only in the case of relatively new fields, like information system management (Baskerville & Myers 2009: 647), or practically oriented disciplines like management generally (Whitley 1984), but also for theoretically oriented sociology (Tuner & Turner 1990) (Cole ed. 2001; Fuchs 2001). This problem is very complex, ranging from the cognitive mode of the social sciences (Abbott 2001), to the maturity of a discipline, or the organizational power of a scientific community (Stinchcombe 2001).

The final reason is the existing methodological gap. It is important to control the precision of the sampling procedure. As it will be explicated further, we based our sampling procedure on keywords assigned to research articles, which is a common method in studies of invisible colleges (Zuccala 2006: 152), and it is used without reflection and uncritically. However, keyword search does not necessary result in the relevant literature that is in the researcher's mind. Even if the field somebody is interested in has some good descriptive terms, or a combination of them, the resulting corpus of text may contain irrelevant documents. We utilize a technique that combines keyword and co-citation analysis in order to avoid these errors.

Data and sampling procedure

We used bibliometric information from Web of Science's Social Science Citation Index. In order to place ONS in its context but limit the size of our database, we gathered data on five relevant disciplines regarding ONS: Business Science, Economics, Geography, Information and Library Science, Management and Sociology. A sample of an approximately three year interval was used for the analysis — from 2008 to the May of 2011 when the data was collected. Only English language research articles were collected, because translation of books as citations would bias the analysis. This dataset contains 80 520 articles. With the cited documents the corpus adds up altogether to 1 449 182 distinct documents. The largest component of the citation network includes 77 211 from the original 80 520 and it was selected as the object of analysis.

To find the relevant literature concerning organization networks, we used a combination of search words. Because the relevant articles can be defined as research that focuses on the relationships between formal organizations the terminology of the articles had to refer to both the organizations and the ties under study. A word list was generated trying to grasp the possible references to both notions (Appendix I) (plural forms also included in the selection procedure). The search criterion was applied for the text in the title, keywords, and abstract and it was the following. References to organizations are quite common (66%), because of this the relevant articles had to have at least two instances of using terminology from our world list. This criterion covered 42% of the sample. It was also reasonable to look for articles using more than once the relevant terms, because organizations have to be the main research territory of these articles. At the same time this selection criteria is still inclusive, which is important, because the resulting bibliometric database was then narrowed and refined by applying citation analysis. The search criterion for relationships and relationship structures was applied on the keyword level, because it is considered as a distinction of an article by the authors or the classificators. This phenomena can be illustrated by the example of the journal Social Networks. Although it is specialized in network analysis, the keywords in the database are always referring to networks, because Web of Science applies its own keyword system. The network keywords covered 9% of the database, and finally by combining the two criteria 4001 articles remained, approximately 5%.

For the comparative analysis three other fields were selected from the main dataset. The sampling principle for the comparative analysis was to involve a diverse set of science fields, to include the discipline level, a well founded research specialty and a trend, like focus of studies.

Sociology represents the discipline, and it was circumscribed in the dataset, by simply using the journal classification system of Web of Science (8930 articles). An earlier study (Moody & Light 2006: 67) indicates that sociology has an interstitial character among the social sciences, as it is intensively sharing knowledge with other social science disciplines. So, in some sense, sociology is a less integrated research field.

The research specialty was represented by innovation studies, which is a relatively mature specialty within the social sciences, and gaining more and more attention (Fargerberg & Verspagen 2009: 218). This field has its own journals and conferences. The keyword for selection was simply "innovation" (4192 articles).

The research trend was e-commerce within the field of information systems management. The reason for the focus on information systems management was to find one relatively clear aspect of this new type of economic activity. E-commerce became a popular research topic in the middle of the nineties within information systems management (Baskerville & Myers 2009: 647), and it is still a prominent field (542 articles). The search terms in the keyword field were "electronic commerce", "e-commerce", "ecommerce", and the search was restricted to information and library science.

Integrity

The integrity or the intellectual magnitude of a given field was measured on the simple article to article citation network and the bibliographical coupling network, where weighted ties are formed between articles, if they cite the same document. We assume that references represent the basic knowledge, which makes scientists able to communicate with each other (Small 1978: 327), and which is a means of training and socialization of social scientists. Two graph concepts were utilized in that analysis, the shortest paths, and homophily. These measures complement each other: the first one considers the given field as a separate entity, and testing its internal constitution, while the other places it into the whole network and testing whether it has its own boundaries. If the given field shows relatively high integrity on both measures, then it is a community of the overlapping and nested structure of the network, and an important organizational factor of the scientific discourse.

The average geodesic distance, or the average shortest path length between articles within the fields was measured on the co-citation network*. A short path length indicates that there is a higher probability of two articles sharing knowledge by citing the same high impact article or book. It means that the field has a cohesive knowledge core, authors easily link to each other by reading the same set of articles and books. The geodesic distance is affected by the size of the graph, or to put it differently, it is harder for researchers of larger fields to read all relevant literature, and to be up to date, than it is for members of smaller fields. For this reason, the randomly expected geodesic distance was also calculated and compared to the observed one. This comparison shed light on another network phenomenon, namely the fragmentation into subgroups. If the randomly expected average geodesic distance is considerably larger than the one actually observed, then it is probable that the research field is factional.

To measure homophily, the Coleman homophily index was used (Currarini et al., 2010: 4857):

$$\frac{\frac{S_I}{W_I} - P_I}{1 - P_I}$$

where S_I is the average number of within group tie weights for group I, and W_I is the average number of tie weights in group I. P_I indicates the relative size of group I among all other groups. The index is larger than 0 if members of group i are homophile; and

* This network is constituted by the articles that are representing the given field during the sampling period and their citations, except the citations between these articles of the given field (approx 4–5% of all citations). This yields a bipartit network.

smaller than 0 if they behave in a heterophile manner (in this case the article belongs to another hypothetical group(s) in the bibliographical coupling network). If the index is 0, the nodes do not pay attention to group membership when forming a tie. Homophily in our context means that the field is detached from other intellectual endeavors: it is using and producing knowledge which is not much shared with other fields.

The following formula, which based on homophily, is able to detect errors of the sampling procedure for individual articles:

$$\frac{S_i}{W_i \cdot P_I}$$

in which W_i is the tie weight of node i and S_i is node i's internal tie weight in its group. If this value is below 1 the node has lesser ties inside its group than randomly expected, and is considered as "misplaced".

According to the value of the homophily index for individual articles, the selection procedures based on keywords and words are quite accurate. Sociology (see Table 1) which was selected according to the classification of journals indicates more heterophily or error (8%), than the other three fields selected by keywords and words contained in the abstracts and titles (e-commerce: 0%, innovation studies: 3%, ONS: 6%).

Table 1

Homophily and average geodesic distances of the fields

	Homophily		Average geodesic distances		
	heterophily	mean	observed	random	ob./rand.
Organizational Network Studies	6%	0.27	5.06	4.42	1.14
Innovation Studies	3%	0.31	4.74	4.38	1.08
E-commerce	0%	0.10	4.70	4.10	1.15
Sociology	8%	0.31	5.70	4.99	1.14

If ONS is a well-founded research field it must have close values on all measures to innovation studies and sociology, and it must have stronger integration than e-commerce. The results are supporting this assumption. Innovation studies and sociology has the highest homophily index (0,31), while e-commerce the lowest (0,1). ONS's homophily (0,27) is closer to innovation studies and sociology.

The geodesic distances are the shortest in the case of e-commerce, while sociology has the longest one. This is mainly because e-commerce is the smallest, while sociology is the largest field. Organization network studies have approximately 5 average shortest path length in its citation network and it means that the probability that two articles are citing the same document is 1/2,5 or 0,4, while in the case of innovation studies it is 1/2,35 or 0,43. If these values are controlled for size, the resulting ratios are quite the same, the average shortest path lengths are longer 1,15 times than the randomly expected, however innovation studies still indicating stronger integrity. To sum up, 1) all fields are cohesive nearly to the same extent; 2) e-commerce has blurred boundaries 3) ONS is a less closed field than sociology and innovation studies, but it is close to their integrity.

Internal organization of the field

In this section of the article we characterize the ONS corpus by inspecting frequently publishing journals of the field, and highly cited books and articles. We also present the results of a community detection procedure performed on the bibliographical coupling network. This analysis aims to give a snapshot of the specializations within ONS and the core knowledge of the field.

The list of top fifteen journals according to the raw volume of ONS articles published (Table 2) contains four from the top fifteen management journals (approximately the first percentile) ranked by ISI Social Sciences Citation Index (impact factor in Journal Citation Reports 2010). These are the Academy of Management Journal, the Strategic Management Journal, Journal of International Business Studies, and the Journal of Management Studies. The ratio of ONS articles among the total publications of these four journals is around 20-30%, which is a quite significant proportion. The topics which the specialized journals cover is also informative. Four journals publish on the field of innovation studies (Research Policy, International Journal of Technology Management, Technovation, Industry and Innovation), two on regional economics (Regional Studies, Entrepreneurship and Regional Development) and two on business-to-business marketing (Industrial Marketing Management, Journal of Business and Industrial Marketing).

Table 2

Top fifteen journals according to the raw volume of ONS articles published

Journals	Number of citations
INDUSTRIAL MARKETING MANAGEMENT	101
RESEARCH POLICY	83
JOURNAL OF BUSINESS ETHICS	73
INTERNATIONAL JOURNAL OF TECHNOLOGY MANAGEMENT	68
STRATEGIC MANAGEMENT JOURNAL	62
TECHNOVATION	55
JOURNAL OF MANAGEMENT STUDIES	53
REGIONAL STUDIES	51
JOURNAL OF INTERNATIONAL BUSINESS STUDIES	46
JOURNAL OF BUSINESS RESEARCH	43
ACADEMY OF MANAGEMENT JOURNAL	41
INDUSTRY AND INNOVATION	40
ENTREPRENEURSHIP AND REGIONAL DEVELOPMENT	40
SERVICE INDUSTRIES JOURNAL	38
JOURNAL OF BUSINESS AND INDUSTRIAL MARKETING	37

Highly cited articles and books from the top 25 show somewhat different picture (Table 3) on specializations. This list gives us a picture of the core knowledge, those ideas that have significant influence on the field. Regional economics and international business studies are marginal (Michael Porter's (1990) influential book on business clusters is the last one on the list), but the interpreter has to be cautious, because the list does not give a representative picture of the knowledge core: only 52% of the ONS articles cite at least one study from the top 25 articles and books. It means that the largest discipline, namely management, is overrepresented, and the high impact articles of smaller fields, like regional economics, are underrepresented.

Table 3

Top-cited articles and books of ONS

Citation	Document
377	Cohen M.W., Levinthal D.A. Absorptive Capacity: A New Perspective on Learning and Innovation // Administrative Science Quarterly. 1990. Vol. 35. No 1. P. 128—152.
337	Granovetter M. S. Economic action and social structure: The problem of embeddedness. // American Journal of Sociology. 1985. Vol. 91. No 3. P. 481—510.
319	Burt R.S. Structural holes: The social structure of competition. Cambridge, MA: Harvard University Press, 1992.
275	Granovetter M. S. The strength of weak ties // American Journal of Sociology. 1973. Vol. 78. No 6. P. 1360—1380.
270	Uzzi, B. Social Structure and Competition in Interfirm Networks: The Paradox of Embeddedness // Administrative Science Quarterly. 1997 Vol. 42 No 1. P. 35—67.
246	Barney J. Firm Resources and Sustained Competitive Advantage // Journal of Management, 1991. Vol. 17. No 1. P. 99—120.
245	Dyer J., Singh H. The Relational View: Cooperative Strategy and Sources of Interorganizational Competitive Advantage // Academy of Management Review. 1998., Vol. 23. No 4. P. 660—679.
243	Powell W. W., Koput K. W. Smith-Doerr L. Interorganizational Collaboration and the Locus of Innovation: Networks of Learning in Biotechnology Administrative Science Quarterly. 1996. Vol. 41. No 1. P. 116—145.
243	Oliver Williamson: The Economic Institutions of Capitalism. New York: Free Press. 1985.
231	Eisenhardt K. Building theories from case research // Academy of Management Review. 1989. Vol. 14. No 4. P. 532—550.
194	Williamson O. Markets and Hierarchies: Analysis and Antitrust Implications, New York: Macmillen, Free Press; London: Collier Macmillen.1975.
185	Nahapiet J., Ghoshal S. Social capital, intellectual capital, and the organizational advantage // Academy of Management Review. 1998. Vol. 23. No 2. P. 242—267.

Citation	Document
173	Kogut B., Zander U. Knowledge of the firm, combinative capabilities, and the replication of technology // Organization Science. 1992. Vol. 3. No 3. P. 383—397.
173	Pfeffer J., Salancik G. R. The External Control of Organizations: A Resource Dependence Perspective. New York: Harper and Row. 1978.
164	Nelson R. R., Winter S. G. An Evolutionary Theory of Economic Change. Cambridge, MA: Harvard University Press. 1982.
161	Uzzi B. The sources and consequences of embeddedness for the economic performance of organizations // American Sociological Review. 1996. Vol. 61. No 4. P. 674—98.
156	Gulati R. Does familiarity breed trust? The implications of repeated ties for contractual choice in alliances // Academy of Management Journal, 1995. Vol. 38. No 1. 85—112.
156	Teece, D., Pisano G., Shuen A. Dynamic capabilities and strategic management // Strategic Management Journal. 1997. Vol. 18. No 7. P. 509—33.
154	Wasserman S., Faust K. Social Network Analysis: Methods and Application, Cambridge, MA: Cambridge University Press, 1994.
152	Morgan R., Hunt S. The commitment-trust theory of relationship marketing // Journal of Marketing. 1994. Vol. 58, Pp. 20—38.
146	Fornell C., Larcker D. F. Evaluating Structural Equation Models with Unobservable Variables and Measurement Error // Journal of Marketing Research.1981. Vol. 18. No 1. P. 39—50.
145	Podsakoff P. M., MacKenzie S. B., Lee J. Y., Podsakoff N. P. Common method biases in behavioral research: A critical review of the literature and recommended remedies // Journal of Applied Psychology. 2003. Vol. 88. No 5., Pp. 879—903.
142	Hansen M. T. The Search-Transfer Problem: The Role of Weak Ties in Sharing Knowledge across Organization Subunits // Administrative Science Quarterly March. 1999. Vol. 44. No 1. P. 82—111.
138	Grant, R. M. Toward a Knowledgable-Based Theory of the Firm // Strategic Management Journal. 1996. Vol. 17. P. 109—122.
135	Porter M. The competitive advantage of nations. New York: Free Press, 1990.

Important concepts of social network analysis that are relevant for inter-organizational studies are represented in the list: weaek ties, structural holes, conceptualizations of embeddedness, and the graph theoretic methodology SNA. The classics of transaction costs economics also appear on this list. It is interesting to note, that a considerable amount of articles and books are concerning the innovation capacity of organizations, some of them directly focusing on the cooperative aspect of innovative activity. Some methodological texts are also on this list, like the influential SNA method book by Wasserman and Faust (1994). Two quantitative methodology texts

and one concerning case studies are present. To sum up, the dominance of management is inevitable, while there is a strong focus on innovation and the prominence of the classics of embeddedness and resource-based organizational research is observable.

The above analysis indicated that there is a certain topical diversity within the field. In order to reveal this diversity directly we mapped the internal structure of the bibliographical couplings. For this purpose the Louvain algorithm was applied (Blondel et al. 2008: 10008), which is a modularity maximizing algorithm. However, this analysis did not give a satisfactory clustering solution. It reached maximum modularity at 0.23, well below 0.3, which is the expected limit for a meaningful community structure. Although by observing important journals and research documents of the field one can identify different roots of ideas, as well as different venues of scientific knowledge sharing, the field is not organized into sub-clusters according to the algorithm. This result matches the conclusion of integrity analysis.

The Disciplinary Context

In this last section of the article we put ONS into its disciplinary context. We inspect the disciplinary constitution of the field presenting the result of a journal-to-journal citation network. This latter one will give us more information on knowledge sharing and scientific prestige.

As is expected from the analysis of journals and citations, Management and Business Science produce the largest number of ONS publications. 11–12 % of all articles from these disciplines are ONS ones (Table 4). Information science and geography is around the average on this respect with 5–6%. Surprisingly, sociology, which is an important discipline of the knowledge core (11%), is penetrated by this discourse with only 3%. Finally, economics is the least concerned with this paradigm in spite of the fact that it has extremely strong (and the strongest) influence on the field.

Table 4

Size and penetration of ONS disciplines

	Size of the discipline	Penetration by ONS
Business	15%	11%
Economics	42%	2%
Geography	4%	6%
Information and Library Science	8%	5%
Management	20%	12%
Sociology	11%	3%

The fact that economics is not involved in organizational network research is strikingly represented in Figure 1. In this figure the ties represent the number of citations from one journal to another. This is a hierarchical, asymmetric network. In

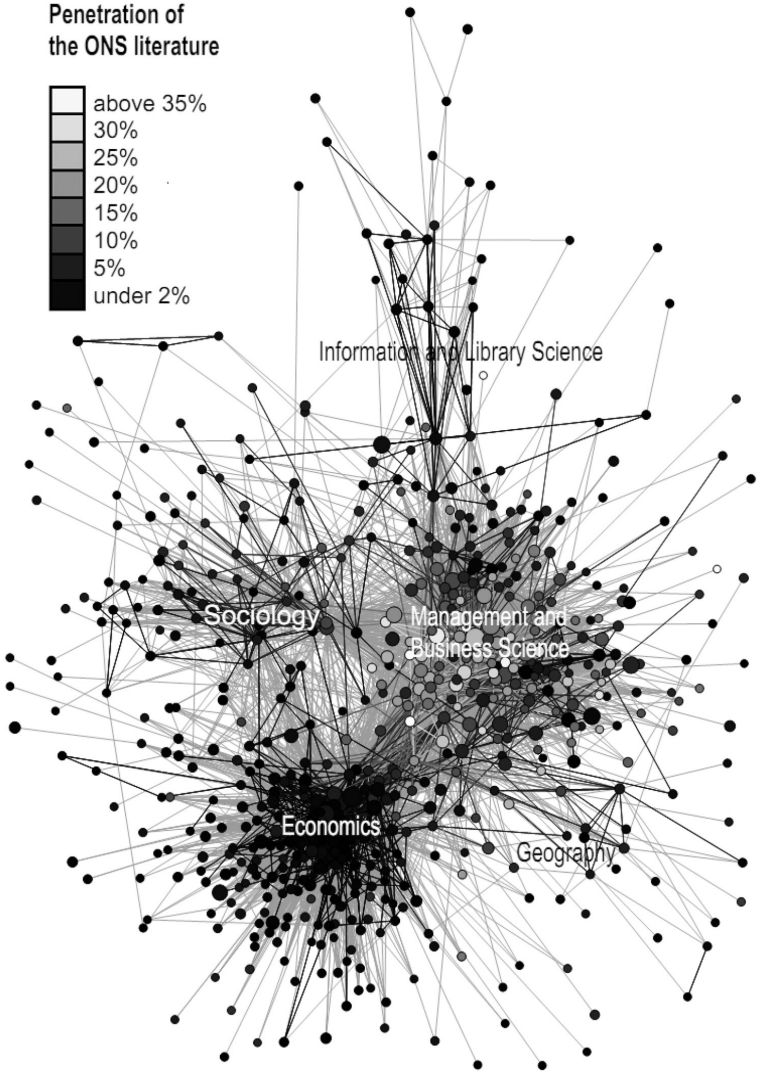

Figure 1. ONS journal citations network

the figure only the ties equal or above 20 are drawn to gain a clear picture. The Yifan Hu Proportional (Hu 2006: 1360) algorithm was applied for the layout, which is implemented in Gephi (Bastian et al. 2009). In order to make the hierarchical aspect more pronounced, the radiuses of the nodes are proportional to the journal's in-degree,

which indicates its impact. The nodes are colored on a greyscale according to the percent of ONS articles published by them (lighter tones indicates more ONS).

The macro structure reveals the volume and coherence of economics and management & business science as ONS communities of journals, and their separation from each other is also salient. Management & business science (M&BS) seems to be a "looser" community than economics. M&BS journals are not centralized as strongly as economics, and M&BS is intensely communicating with the other disciplines. Certainly M&BS is bounded with information systems management, while library science is separated from it to some degree. Information and library science, geography and sociology are less pronounced structurally.

What is important for our concerns is that the broadly conceived core of M&BS is strongly penetrated by ONS. As it is evident from the list of top ONS journals (Table 2), top management journals publish a lot of ONS articles. From the disciplinary analysis it is also evident that this field is extensively represented in management. It is interesting to note, that two key journals of sociology, the American Sociological Review and the American Journal of Sociology are both publishing ONS, and they are strongly connected to M&BS, in fact they are in between M&BS and sociology. This corresponds with the list of top citations (Table 3), where some of the highly cited articles appeared in these journals.

Conclusions

The article presents a bibliometric study of organizational network research.

The results show that ONS is an integrated field of study almost equally organized as such fields as innovation studies and sociology, and has firmer boundaries as a research endeavor than research on e-commerce.

The analysis of ONS knowledge core put into its disciplinary contexts revealed that the literature on innovation processes, the classics of the embeddedness paradigm of the economy and the resource-based view of organizational economics are well accentuated among the cited articles and books, and these constitute the most important intellectual roots for ONS. The spectrum of specializations and research topics that are involved in ONS is wide; it ranges from regional economics, through business-to-business marketing to innovation studies.

ONS frequently appears in management science journals, and it is published in the core, high impact journals of both management & business science and sociology forming important axes of knowledge for this line of research. However, economists rarely publish on organizational networks, although some core journals publish ONS articles on a low scale.

The investigation presented in the paper is only the first step to test cohesiveness of the field of ONS because of its limitations: we described the results of a cross-sectional analysis, and a limited context for comparison with different fields. In order to give precise answers to the proposed question a dynamic and more extensive research framework would be desirable.

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Appendix I. ONS Publications Search Terms

Network keyword	Organization
alliance	company
cluster	competitive
collaborate	competitor
collaborative	corporation
cooperate	corruption
cooperative	economic
diadic	economy
dyad	enterprise
embed	entrepreneur
embeddedness	firm
network	government
partner	governmental
partnership	governmentality
reciprocity	management
tie	managing
	manufacturer
	market
	marketing
	organisation
	organization
	policy
	SME, small and medium enterprises
	corruption
	manufacturer