Science Advances

Supplementary Materials for

Document co-citation analysis to enhance transdisciplinary research

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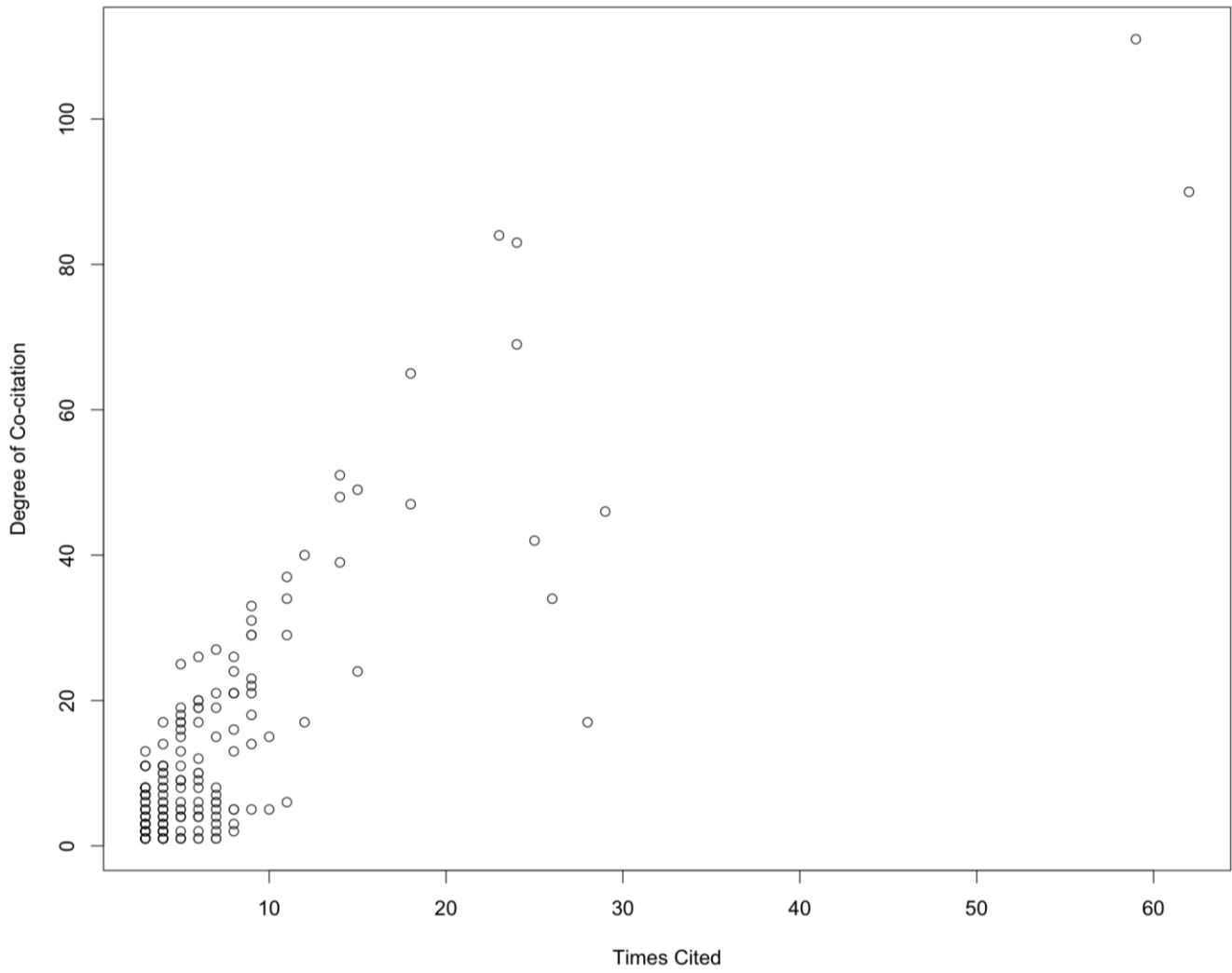
fig. S1. Scatterplot of times cited and degree of co-citation for ≥3 systems thinking network. A line of best fit was not added because these data are nonparametric.
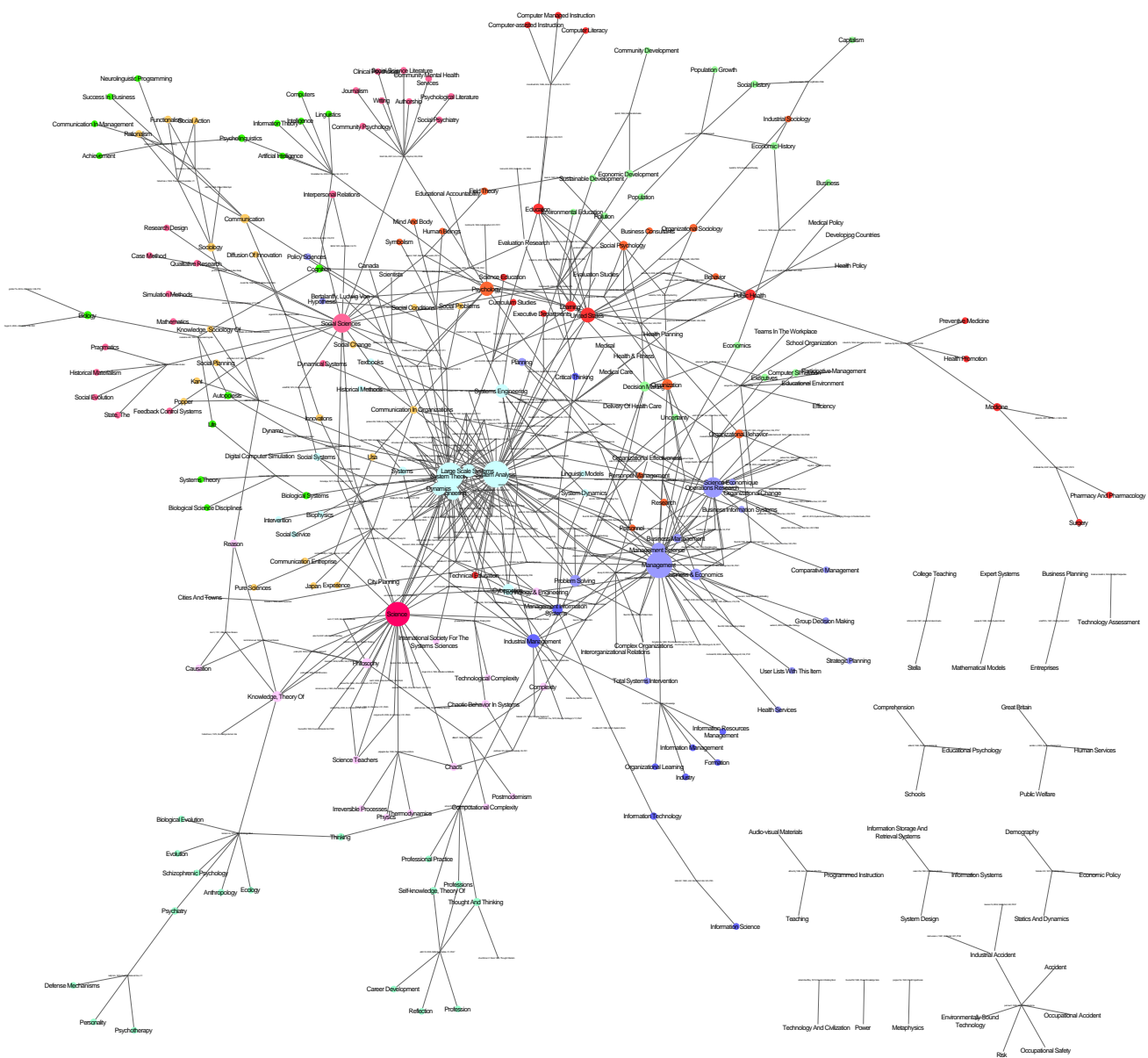
fig. S2. Network representation of co-cited documents organized as subject communities. Documents from the >3 co-citation network are represented with corresponding subject labels derived from WorldCat.org. Documents grouped according to a SLM community detection algorithm and visualized with organic layout in Cytoscape. Resultant subject communities were compared to co-citation communities as a part of a validation process.

table S1. Tabulation of documents from identified co-cited communities (≥3 network) to identified subject communities (fig. S2). Subject communities are labeled to represent the most prominent subject term in each grouping.

Subject Community	Total	Co-citation Community							
		0	**1**	**2**	**3**	**4**	**5**	**6**	**Other**
A. System Analysis	51	13	11	8	3	10	6	0	0
B. Management	38	10	8	8	0	11	1	0	0
C. Science	28	2	3	7	11	0	3	0	2
D. Social Sciences	15	6	4	2	1	0	1	1	0
E. United States	17	3	1	0	8	0	0	5	0
F. Psychology	14	4	3	3	0	2	0	0	2
G. Communication	9	2	0	5	0	0	1	0	1
H. Decision Making	10	5	2	0	0	1	1	1	0
I. Biology	8	1	2	0	4	0	1	0	0
J. Thought And Thinking	5	0	1	3	1	0	0	0	0
K. Industrial Management	11	2	2	1	1	4	0	0	1
L. Evaluation Research	5	3	0	0	0	0	0	2	0
M. Organizational Change	6	2	0	1	1	1	1	0	0
Other subject community	19	5	5	2	2	1	2	0	2
No subject data available	10	1	2	0	1	1	5	0	0
Total	246	59	44	40	33	31	22	9	8

table S2. An annotated bibliography of six useful resources for understanding DCA and other types of bibliographic networks.

Small, H. (1973). Co- citation in the scientific literature: A new measure of the relationship between two documents. *Journal of the American Society for Information Science, 24*(4), 265-269. DOI: 10.1002/asi.4630240406
This pioneering paper provides an accessible point to understand how document co-citation measures are calculated and how they provide information about knowledge structure within a scholarly domain.

Leydesdorff, L. (1998). Theories of citation? *Scientometrics, 43*(1), 5-25. DOI: 10.1007/BF02458391.
The author of this paper develops a theoretical framework to understand the meaning ascribed to citation of authors, groups of authors, documents, and groups of documents. This report connects citation patterns to representations of social structure and cognitive resources.

Börner, K., Chen, C., & Boyack, K. W. (2003). Visualizing knowledge domains. *Annual review of information science and technology, 37*(1), 179-255. DOI: 10.1002/aris.1440370106
This document reviews a variety of ways knowledge domains have been visualized and provides a methodological approach for turning data into graphics. Written as an overview, this work provides data processing workflows, summarizes technology, and illustrates with examples.

Börner, K., Sanyal, S., & Vespignani, A. (2007). Network science. *Annual Review of Information Science and Technology, 41*(1), 537-607. DOI: 10.1002/aris.2007.1440410119
This review of network science provides useful definitions and background to understand and analyze networks as graphs. Readers interested in network analysis will find this document informative for measuring, sampling, modeling, and visualizing network data.

Sci2 Team (2013) Science of Science (Sci2) Tool Manual v1.1 beta. Indiana University and SciTech Strategies, Available online at: http://wiki.cns.iu.edu/display/SCI2TUTORIAL/Home
Science of Science (Sci2) is free software and the Sci2 user-manual provides an online tool to understand the capabilities of Sci2. The manual includes instructions to operate the program, details of different algorithms implemented with references to primary literature, designs for workflows, and worked examples.

Van Eck, N.J., & Waltman, L. (2014). Visualizing bibliometric networks. In Y. Ding, R. Rousseau, & D. Wolfram (Eds.), *Measuring scholarly impact: Methods and practice* (pp. 285–320). Springer. DOI: 10.1007/978-3-319-10377-8_13
This more recently published document provides tutorials for visualizing bibliographic networks beyond co-citation networks. The authors provide a list of programs available online that may help aid analysis of different types of bibliographic measures to gain additional insights from bibliographic information.