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Who Are the Gatekeepers? An Examination of Diversity in INFORMS Journal Editorial Boards

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Abstract. Publishing in respected scholarly journals is critical to academic success. However, if journal editorial boards fail to reflect the diversity of thought in a field, worthy work may be overlooked. This study assesses the level of diversity in the editorial boards of the 16 INFORMS journals. We examine gender, whether an individual is an underrepresented minority, and institutional affiliation, and perform a network analysis to identify coauthor relationships between editorial board members. We find that the editorial boards have low levels of diversity: women comprise just under 20% of the editorial board members; fewer than 1% of editorial board members are underrepresented minorities; and 10 institutions (less than 5% of the total) account for more than 25% of the editors. We find a high level of connectivity between editorial board members (as measured by coauthor relationship) for some of the INFORMS journals, suggesting the influence of an "in crowd" of like-minded individuals. INFORMS can and should work to end this state of affairs: we provide a set of actionable recommendations for broadening diversity and reducing connectivity on the INFORMS journal editorial boards. In this way, INFORMS journals can support a diversity of backgrounds and views, enabling the publication of a broader range of ideas and invigorating academic discourse in our profession.

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Keywords: application and case study • service design • satisfaction and excellence

1. Introduction

Publishing in respected academic journals is critical for faculty members seeking promotion, recognition for their work, and research funding, and for doctoral students seeking jobs. Scholarly publication also affects the external prestige of academic departments and institutions. Sometimes, though, journals may have nondiverse editorial boards that tend to view certain types of research and methodological approaches as more deserving of publication than other types of research and methodological approaches. According to one critique of scientific journals, "a handful of gatekeepers limit the flow of information" (Lin 2012). The result is that worthy work is sometimes not accepted for publication in key journals.

In this study, we assess the level of diversity in the editorial boards of the 16 INFORMS journals. Here we think of diversity as both of people (e.g., men, women) and ideas (different viewpoints). These factors are related but not the same: diverse individuals are likely to have a diversity of viewpoints, but individuals who are demographically similar can also have diverse viewpoints.

Numerous studies have shown that diversity of people leads to advances in science, engineering, and medicine, among other fields (e.g., McLeod et al. 1992, Hong and Page 2004, Campbell et al. 2013, Smith-Doerr et al. 2017, Hofstra et al. 2020). According to a 2014 report in *Scientific American*, "Decades of research by organizational scientists, psychologists, sociologists, economists and demographers show that socially diverse groups (that is, those with a diversity of race, ethnicity, gender and sexual orientation) are more innovative than homogeneous groups" (Phillips et al. 2014, p. 43). A comprehensive review of the link between diversity of people and diversity of ideas can be found elsewhere (Stewart and Valian 2018). To reflect a diversity of ideas, it is essential that journals reflect the work of their field broadly and that journal editorial boards embrace a diversity of scholars and disciplinary perspectives, as appropriate for the given field.

Previous studies have examined editorial board diversity for journals in areas such as business and management (Svensson et al. 2007, 2008; Metz and Harzing 2009, 2012; Harzing and Metz 2011; Dhanani and Jones 2017), mathematical sciences (Topaz and Sen 2016), medicine, biology, and other sciences (Mauleón et al. 2012, Bhaumik and Mathew 2014, Cho et al. 2014, Piper et al. 2018, Fox et al. 2019, Harris et al.

2019, Jalilianhasanpour et al. 2019, Alkhawtani et al. 2021, Beath et al. 2021), and global health (Bhaumik and Jagnoor 2019, Nafade et al. 2019). One study concluded that low gender diversity on journal editorial boards can influence multiple aspects of scholarly publishing (Fox et al. 2019). The study notes that "poor representation of women among the scientific gatekeepers is likely to reduce the diversity of ideas, perspectives, and values that make it to print: increased representation of women might change which types of manuscripts are accepted for publication, which areas are identified as worthy of invited reviews, which papers are selected to be highlighted by commentaries, and who is chosen to write those commentary and perspective pieces" (Fox et al. 2019, p. 13637). A study of gender diversity in management journals concluded that "The persistent gender imbalance in the editorial boards of many management journals in the last 15 years hinders women's ability to attain scholarly recognition and advancement and carries the risk of narrowing the nature and scope of the enquiry in management" (Metz and Harzing 2009, p. 540). The Association for Information Systems (AIS) has recommended that editorial boards of key journals in which AIS members publish should reflect and represent the diversity of the AIS Membership; it is suggested that this will "communicate or signal a commitment to fairness to all submitters" (Beath et al. 2021).

In this study, we examine three individual-level characteristics relating to diversity: gender, minority status (whether an individual is an underrepresented minority, defined as African American/Black, Mexican American, Native American or Alaskan Native, Native Hawaiian or other Pacific Islander, or biracial with one or more races from this list), and the individual's current affiliation. To explore diversity of viewpoints, we use the proxy of coauthor relationship: if many editorial board members have coauthored papers with other editorial board members, this suggests a level of entanglement that can lead to a narrow editorial viewpoint; conversely, if few coauthor connections exist, the editorial viewpoint may be broader. We perform a network analysis to identify coauthor relationships between editorial board members.

A number of researchers have examined the structure of scientific collaboration networks, finding a high degree of clustering in fields such as physics and computer science (Newman 2001), an association between network centrality and citation counts (Sarigöl et al. 2014, Servia-Rodriguez et al. 2015), gender homophily among collaborators in computer science (Jadidi et al. 2018), and lower citation counts for women in computer science despite similar network connections (Pink and Sarukkai 2021). One study of the faculty job market examined faculty hiring networks, identifying linkages between the school where an individual's doctoral degree was received and the school where the individual was hired (Clauset et al. 2015). To the best of our knowledge, our study is the first to examine coauthorship connections among editorial board members.

2. Methods

For each of the 16 INFORMS journals, we identified the current members of the editorial board from the journal's website (as of July 2020). For most journals, this included the editor-in-chief and the departmental/area editors. For four journals, because the list of area editors was small (five or fewer), we also included associate editors.

For each editor, we created a file with the editor's name, current institution, gender (male or female), and whether the individual was an underrepresented minority (defined as described earlier). We identified gender manually by examining names and, when in doubt, by additionally examining publicly available photos and descriptions of the individual (e.g., on a faculty member's web page). We identified underrepresented minorities manually in a similar way.

For our network analysis, we defined two individuals as being connected if they had coauthored a paper or book. To identify coauthored work, we used publicly available information from Google Scholar. We wrote Python code to automate the search for coauthored papers.

We used the Python tool scholarly (Cholewiak et al. 2020) to scrape data from Google Scholar. We made several local modifications to the code to make it run faster for our analyses (e.g., we did not search for paper abstracts). We used the Python tool Name-tools (Stephens 2020) to reconcile names that are potentially the same (e.g., John P. Smith and J.P. Smith).

Our code first checks to determine whether an author has a public Google Scholar profile. We began with a specific query for a given individual's name and then, if no results were returned, we tried a broader query. For example, these are the four successive queries we would use to search for someone named John P. Smith: (1) "John P. Smith" University of California, Davis; (2) John P. Smith University of California; (3) John P. Smith; (4) John Smith. We continued in this way until either we found one or more author profiles that matched or we determined that the author's profile was private.

If we found multiple profiles, we took additional steps to determine which individual is the editorial board member. Google Scholar identifies the name, affiliation, and email address of each individual. We used keywords for editorial board member affiliation (e.g., MIT, Massachusetts, Technology) and checked to see whether any of these keywords appeared in the affiliation or email of the listed authors. We then built a list of possible authors, which we further processed by considering name variants (e.g., John Smith, John P. Smith, and J.P. Smith). If there were still multiple names, we selected the individual that Google listed first (typically the one with the most citations). In cases when a single author had duplicate Google Scholar profiles, we selected one of them.

If we found a Google Scholar profile for an individual, we used the list of papers provided in their profile. If we found no Google Scholar profile (presumably the individual's Google Scholar profile was private), we performed a direct search on the author name to find the papers the person had written. This is slightly less accurate than using a Google Scholar profile, because the list of identified papers may include papers for which this individual is not a coauthor, but is only mentioned (e.g., in the acknowledgments). We eliminated this problem by only considering papers for which the individual is an author. In our search, approximately 90% of editorial board members had a public Google Scholar profile.

In some cases, publications found in Google Scholar did not reflect true coauthor relationships. For example, we would not consider journal editorials, acknowledgments, or introductions to special issues as coauthor relationships, as these are written as part of editorial duties. To avoid counting such papers, we eliminated papers containing certain strings in their titles (e.g., "editor," "thank," "acknowledge," "referee"). Additionally, we excluded any papers with more than six authors. To eliminate other false positives, we added the criterion that the publication had to appear after 1980.

After this search, we had a list of all the editorial board members, a list of papers associated with each person, and the date of each paper (if available). We then performed the following data processing steps before creating the coauthor network: (1) We capitalized names properly and removed nonalphabetic characters (e.g., dashes) and non-Roman characters (e.g., accent marks, tildes) from author names. (2) We removed each author's name from the individual's own papers. (3) We created a list of all individuals with whom this person had coauthored papers. (4) We deleted coauthors who were not editorial board members for this journal (or, in the case of searching across multiple journals, editorial board members who were not on the board of any of the included journals). (5) We standardized names into the individual's full name when possible (e.g., John P. Smith).

We then used the list of authors and papers to build our network. We created a weighted, nondirected graph in which the nodes are editorial board members and connections represent coauthorship. We used the Python tool webweb (Wapman 2020) to build an interactive graph in the browser. The graphs can be colored in a number of ways to highlight different information: we identified editor-in-chief versus other editorial board members, level of connection (node degree), strength of connection (total number of papers coauthored), gender, and current institution. We calculated a number of statistics including percentage of women and underrepresented minorities on the editorial boards, average node degree in the networks (overall and for males and females), maximum degree, number of isolated nodes, number of connected components, and graph density. We also calculated correlation coefficients between various metrics (e.g., year of editor-in-chief's PhD versus fraction of women on the editorial board) and assessed statistical significance using p-values.

All code used in our searches and network analysis is available on GitHub at https://github.com/Arongil/Diversity-Scraper.

3. Results

3.1. Analysis of Individual Journals

Table 1 presents selected summary statistics of the editors and home institutions for the 16 journals, and Table 2 presents summary statistics of the network for each journal. Figures 1–16 show, for each journal, the graph of connections, with the editor-in-chief highlighted (panel (a)); the graph of connections, with women highlighted (panel (b)); a histogram of the degree distribution of the network, with the position of the editor-in-chief highlighted (panel (c)); and a histogram of the top seven most common institutions of the editorial board members, with the institution of the editor-in-chief highlighted (panel (d)). For the institutions displayed in panel (d), in the case of ties we randomly selected which institutions to display, while making sure that the institution of the editor-in-chief was always displayed.

We identified 460 unique individuals among the 499 total editorial board members; some individuals serve on multiple editorial boards. The average fraction of women on the editorial boards was 19.9%, ranging from 6.9% (two women out of 29 editors for the journal *Stochastic Systems*) to 46.7% (14 women out of 30 editors for the journal *Organization Science*). We identified very few underrepresented minorities on the editorial boards: across the 16 journals, among 460 total individuals serving as editorial board members, we identified only three individuals who are underrepresented minorities; one of these individuals served on two different editorial boards.

The 460 individuals who served as editors were at 203 different home institutions. When we examined the home institutions of the editorial board members for each journal individually, we found that in

Table 1. Summary Statistics: Editor and Institution Characteristics of Individual Journals

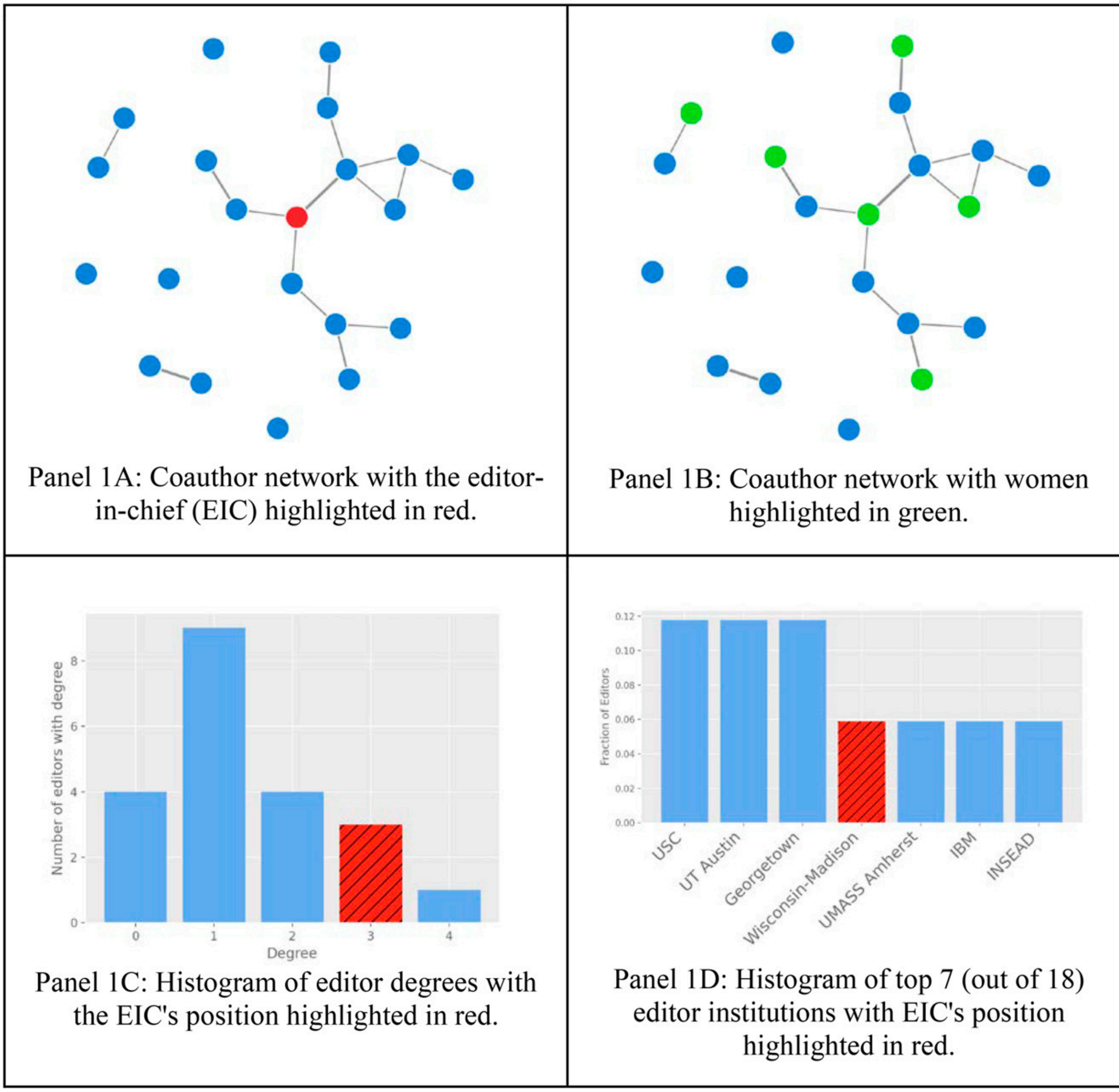
	Journal		Editors				Institutions	
Journal	Annual number of issues published	Annual number of papers published[a]	Year of PhD of editor-in-chief	Total number of editors	Number of women editors	Number of URM editors[b]	Number of editor institutions	Average number of editors per institution
Decision Analysis	4	20	1983	21	6	1	18	1.17
Information Systems Research	4	67	1996	27	5	0	24	1.13
INFORMS Journal on Applied Analytics	6	26	1980	32	4	0	29	1.10
INFORMS Journal on Computing	4	70	1991	11	1	0	11	1.00
INFORMS Journal on Optimization	4	16	1998	16	2	0	12	1.33
INFORMS Transactions on Education	3	17	2006	12	3	0	12	1.00
Management Science	12	297	1987	44	5	0	35	1.26
Manufacturing & Service Operations Management	6	84	1985	83	18	0	49	1.69
Marketing Science	6	61	1998	32	7	0	20	1.60
Mathematics of Operations Research	4	67	1997	69	10	1	50	1.38
Operations Research	6	104	1980	21	4	0	17	1.24
Organization Science	6	73	1996	30	14	0	20	1.50
Service Science	4	10	1992	22	5	1	19	1.16
Stochastic Systems	4	14	1997	29	2	1	25	1.16
Strategy Science	4	18	1985	11	3	0	10	1.10
Transportation Science	4	85	1988	39	8	0	35	1.11

Note. URM, underrepresented minority.
[a]These counts reflect the number of papers published by each journal in 2020.
[b]One individual is appointed to two of the editorial boards, so this column represents three individuals in total.

Table 2. Summary Statistics: Network Characteristics of Individual Journals

Journal	Total number of editors	Average degree	Average degree: Men	Average degree: Women	Degree: Editor-in-chief	Maximum degree	Number of isolated nodes	Number of connected components	Edge density
Decision Analysis	21	1.4	1.4	1.5	3	4	4	7	0.071
Information Systems Research	27	2.4	2.8	1.0	6	8	4	5	0.094
INFORMS Journal on Applied Analytics	32	0.8	0.8	0.5	2	3	14	20	0.024
INFORMS Journal on Computing	11	0.4	0.4	0	0	2	8	9	0.036
INFORMS Journal on Optimization	16	1.9	1.9	2.0	7	7	4	5	0.125
INFORMS Transactions on Education	12	0.5	0.6	0.3	2	2	7	9	0.045
Management Science	44	1.3	1.3	1.4	4	6	15	21	0.030
Manufacturing & Service Operations Management	83	4.4	4.5	4.2	14	19	2	3	0.054
Marketing Science	32	3.1	3.1	2.9	8	8	5	6	0.099
Mathematics of Operations Research	69	1.9	1.9	1.5	3	7	13	17	0.027
Operations Research	21	0.8	0.6	1.5	4	4	13	14	0.038
Organization Science	30	0.6	0.8	0.4	2	2	19	23	0.021
Service Science	22	1.0	0.9	1.2	2	4	9	11	0.048
Stochastic Systems	29	2.4	2.5	1.5	4	7	1	4	0.086
Strategy Science	11	1.6	1.5	2.0	3	3	1	3	0.164
Transportation Science	39	3.0	3.2	2.0	11	12	8	9	0.078

Figure 1. Network and Institution Graphics for *Decision Analysis*

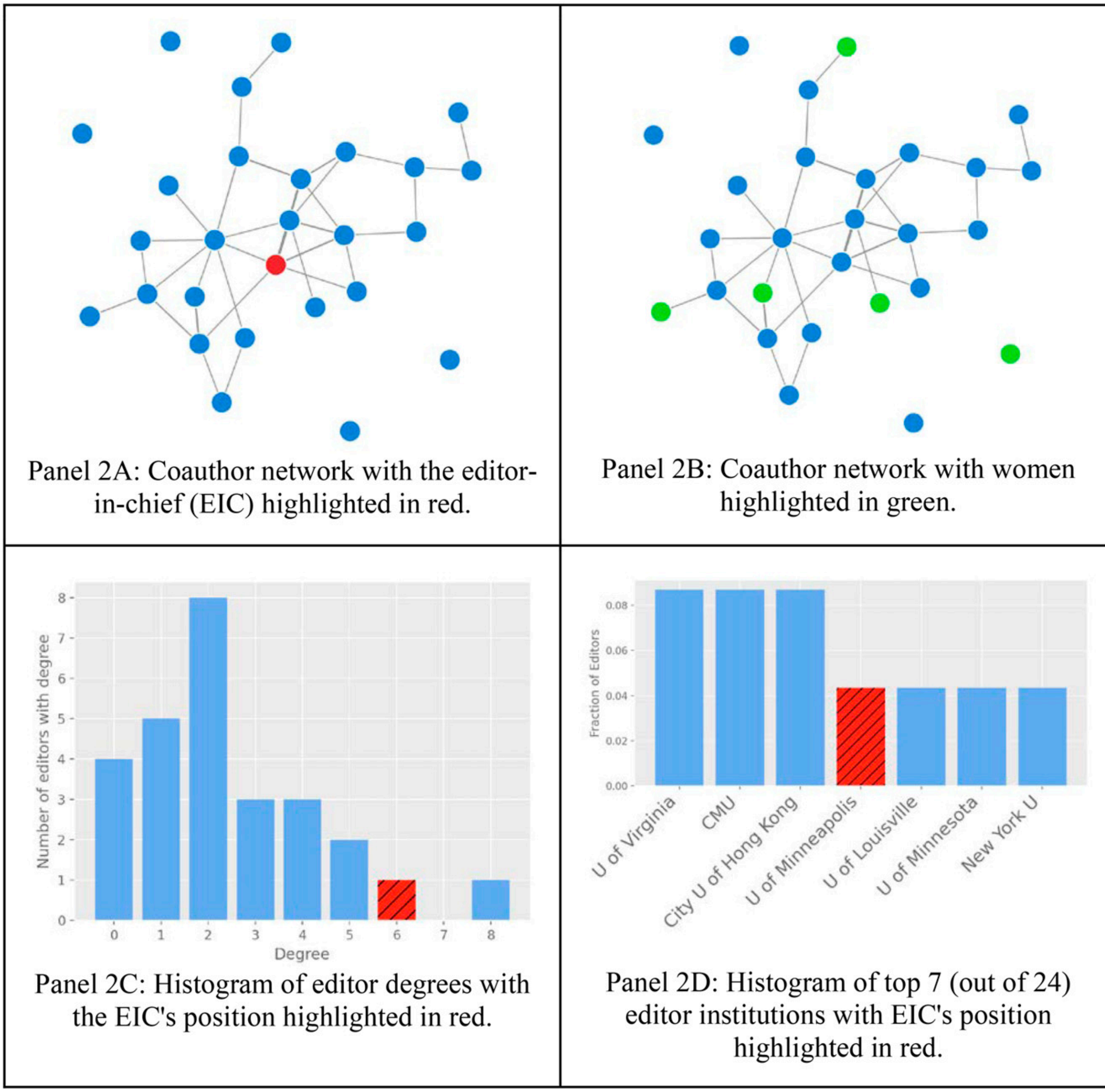


general, each journal's editorial board came from a broad set of institutions (panel (d) in Figures 1–16; complete histograms for each journal are shown in Online Appendix Figure S1). In a few cases, a small number of schools accounted for a disproportionate share of home institutions. The average number of editors per institution ranged from 1.00 (12 editors from 12 institutions for *INFORMS Transactions on Education*) to 1.69 (83 editors from 49 institutions for *Manufacturing & Service Operations Management*).

We also examined the home institutions collectively across all 16 journals. Figure 17 shows a histogram of home institutions for the top 15 institutions by number of editors. In this analysis, an individual serving on two different editorial boards was counted twice to reflect that person's influence on two editorial boards. The top 10 institutions (4.9% of the total) accounted for 24.6% of the editors; the top 15 institutions (7.4% of the institutions) accounted for 33.5% of the editors.

As shown in the figures and in the network statistics in Table 2, there was a high level of connectivity in many of the editorial boards. The average degree of editorial board members (that is, the average number of other board members of the journal with whom this person has published work) ranged from 0.5 (for

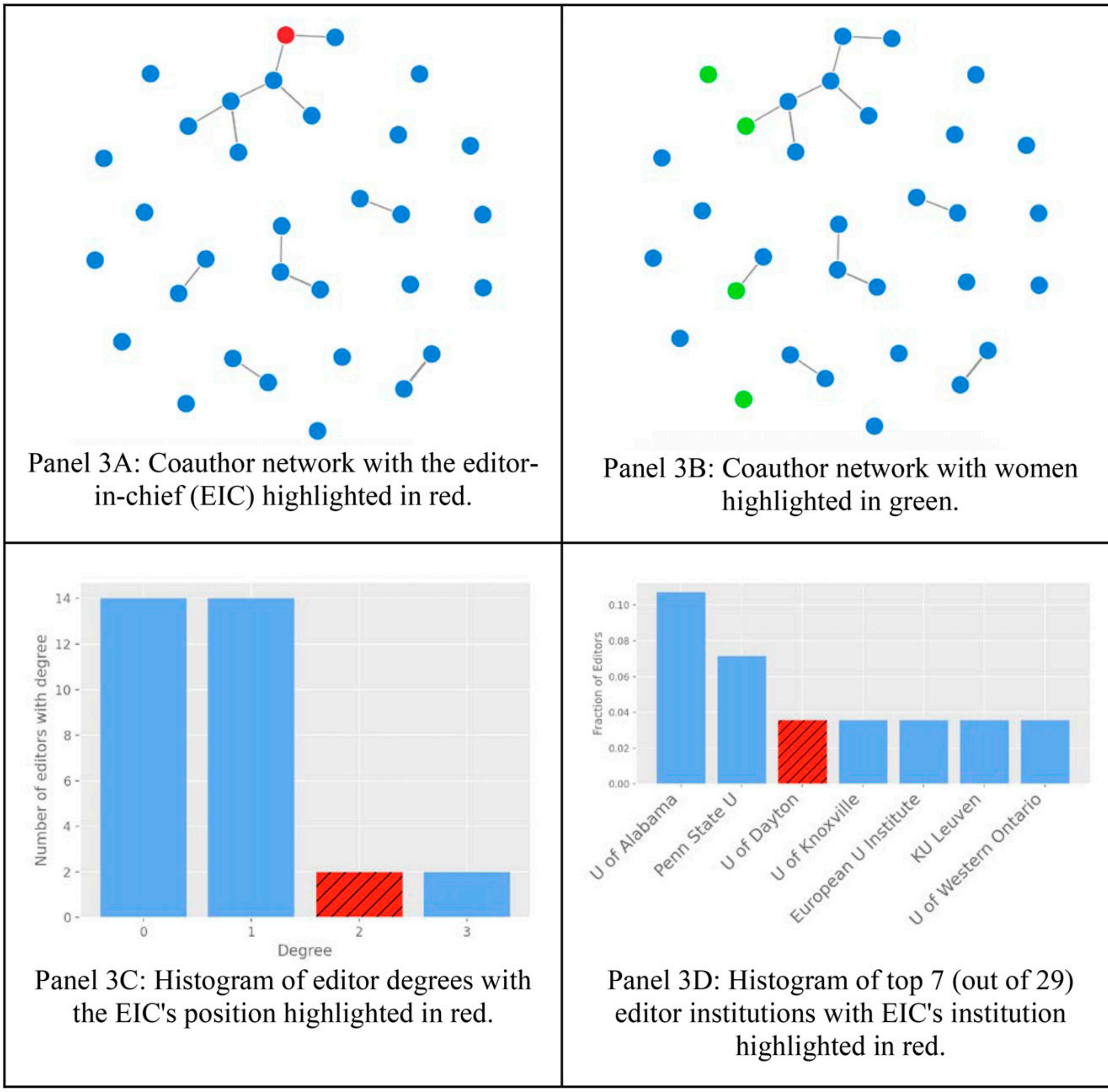
Figure 2. Network and Institution Graphics for *Information Systems Research*



INFORMS Transactions on Education, a journal with 12 editors) to 4.4 (for *Manufacturing & Service Operations Management*, a journal with 83 editors). For *INFORMS Transactions on Education*, the maximum degree of any editor was 2; for *Manufacturing & Service Operations Management*, the maximum degree was 19. Across all journals, the average editor had a degree of 2.15. For 10 of the 16 journals, the average degree of male editors was higher than the average degree of female editors; for six of the 16 journals, the reverse was true. On average, male editors had coauthor relationships with 2.21 fellow editors and female editors had coauthor relationships with 1.86 fellow editors. For 15 of the 16 journals, the degree of the editor-in-chief was higher than the average degree in that journal's network; on average, the editors-in-chief had coauthor relationships with 4.7 fellow editors, 2.6 more than the average editor.

For six journals (*Information Systems Research*, *Manufacturing & Service Operations Management*, *Marketing Science*, *Mathematics of Operations Research*, *Stochastic Systems*, and *Transportation Science*) a significant subset of the editors were part of a large connected component: in the large connected component for the journal were 23 of 27 editors for *Information Systems Research*, 81 of 83 editors for *Manufacturing & Service*

Figure 3. Network and Institution Graphics for *INFORMS Journal on Applied Analytics*



Panel 3A: Coauthor network with the editor-in-chief (EIC) highlighted in red.

Panel 3B: Coauthor network with women highlighted in green.

Panel 3C: Histogram of editor degrees with the EIC's position highlighted in red.

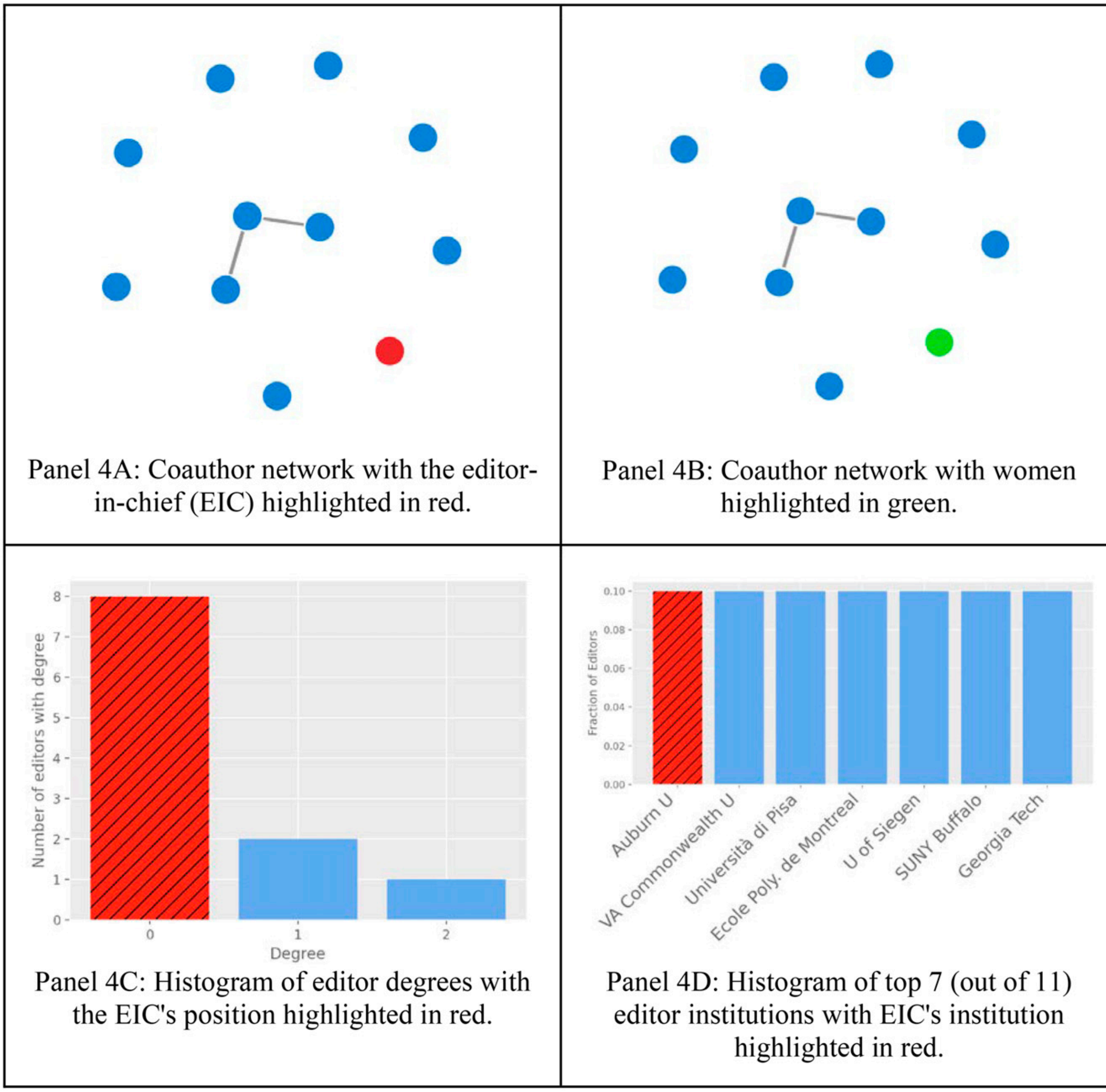
Panel 3D: Histogram of top 7 (out of 29) editor institutions with EIC's institution highlighted in red.

Operations Management, 27 of 32 editors for *Marketing Science*, 48 of 69 editors for *Mathematics of Operations Research*, 24 of 29 editors for *Stochastic Systems*, and 31 of 39 editors for *Transportation Science*. Three journals had a large number of connected components, indicating a much lower level of connectivity: the *INFORMS Journal on Applied Analytics* had 20 components including 14 isolated nodes among its 32 editors; *Management Science* had 21 components including 15 isolated nodes among its 44 editors; and *Organization Science* had 23 components including 19 isolated nodes among its 30 editors.

Of the 499 editorial board members, 25.5% were isolated nodes in the graphs; the remaining 74.5% of editors were part of connected graph components with more than one node. We examined the average size of connected components excluding isolated nodes. The average size of the connected components when calculated in this way ranged from 2.5 (for *INFORMS Transactions on Education*, which has 12 editors) to 81 (for *Manufacturing & Service Operations Management*, which has 83 editors), with the average size being 14.9. This can be compared with the average editorial board size of 31.2.

Measures such as average degree are affected by the number of nodes in the network. To normalize across editorial board size, we also calculated the edge density for each network, which is the average degree (average number of coauthors of an individual) divided by

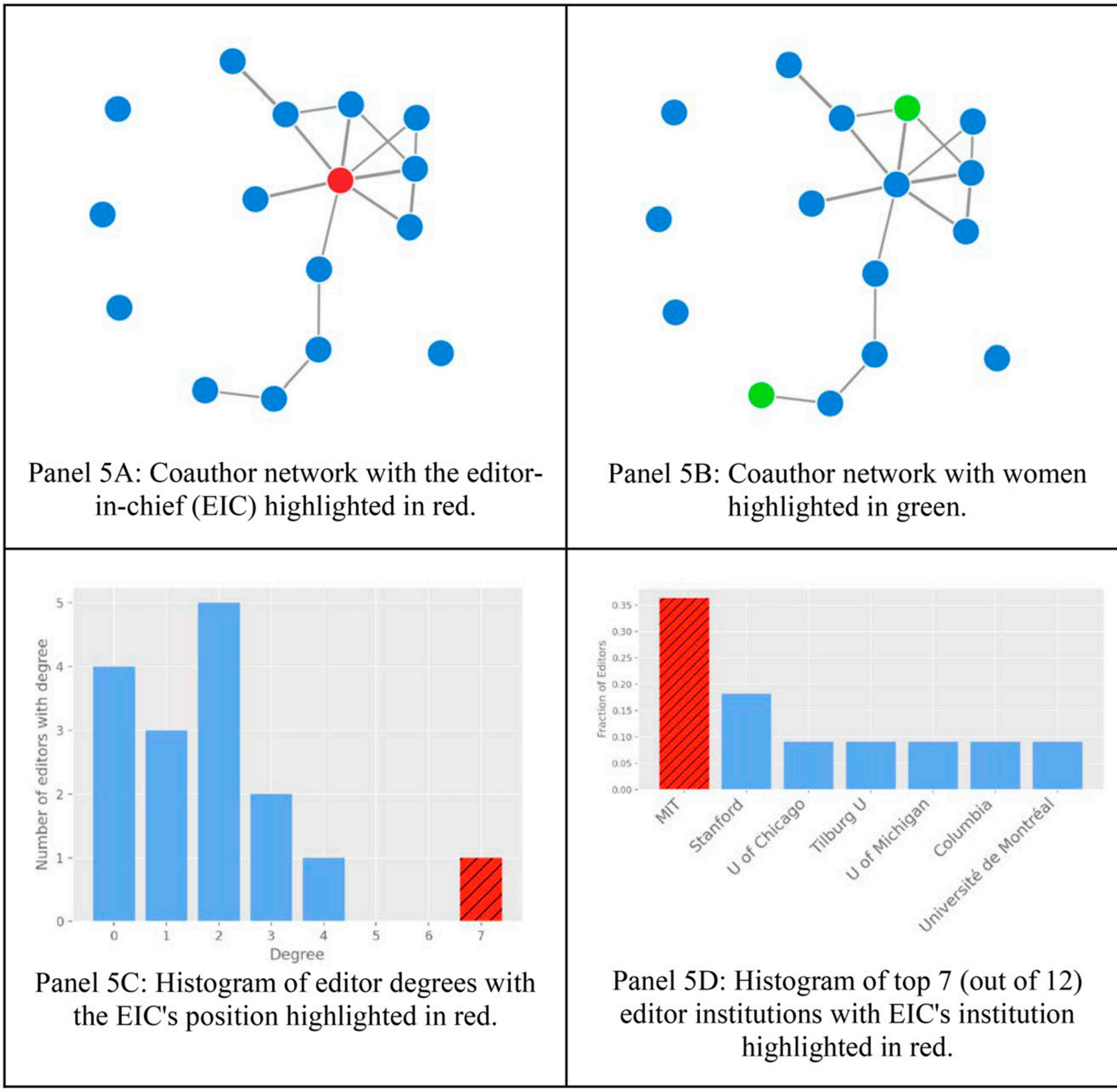
Figure 4. Network and Institution Graphics for *INFORMS Journal on Computing*



the number of nodes minus one (number of other editors with whom an individual could have a coauthor relationship) (Diestel 2017). This metric represents the average fraction of other editors with whom an editor has a coauthor relationship and ranges from 0 for a completely unconnected network to 1 for a completely connected network (in which every node is connected to every other node). Across the 16 journals, this measure ranged from 0.021 (for *Organization Science*, a journal with 30 editors, average degree 0.6, and 23 connected components) to 0.164 (for *Strategy Science*, a journal with 11 editors, average degree 1.6, and three connected components). For seven of 16 journals, this metric was between 0.07 and 0.17, meaning that editorial board members typically had coauthor relationships with 7%–17% of their fellow editorial board members.

In sensitivity analysis, we examined the networks of coauthor relationships when we excluded papers published more than 10 years ago or when we excluded coauthor relationships that consisted of only one joint publication (online appendix Figures S2–S17). The networks were mostly unchanged when we excluded publications more than 10 years old, indicating that most of the coauthor relationships are relatively recent. Additionally, for most

Figure 5. Network and Institution Graphics for *INFORMS Journal on Optimization*



Panel 5A: Coauthor network with the editor-in-chief (EIC) highlighted in red.

Panel 5B: Coauthor network with women highlighted in green.

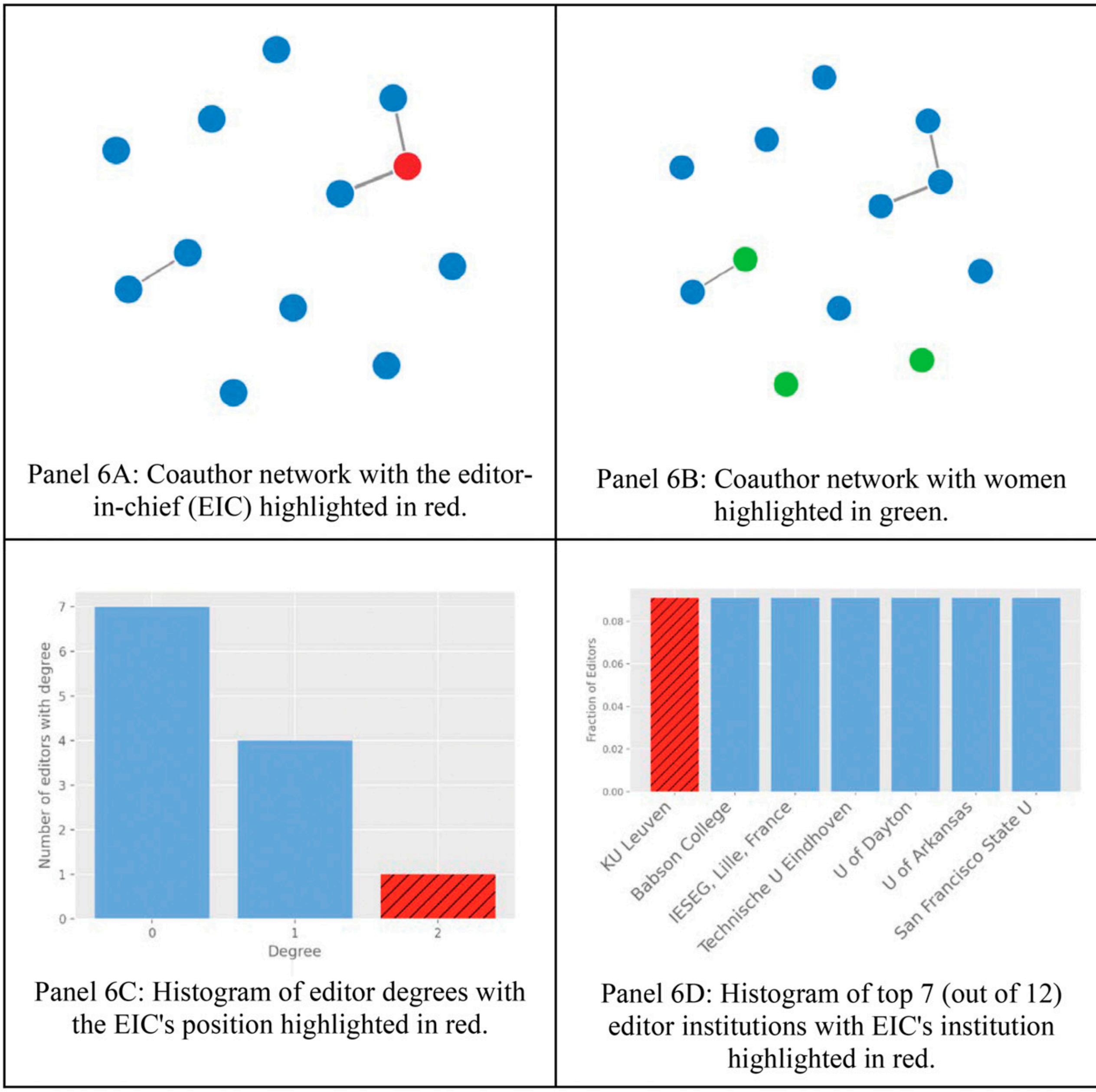
Panel 5C: Histogram of editor degrees with the EIC's position highlighted in red.

Panel 5D: Histogram of top 7 (out of 12) editor institutions with EIC's institution highlighted in red.

journals, the degree of the editor-in-chief was unchanged or little changed when we excluded papers more than 10 years old. When we excluded coauthor relationships consisting of a single publication, the networks were generally less dense, but some journals, such as *Manufacturing & Service Operations Management*, *Mathematics of Operations Research*, *Stochastic Systems*, and *Transportation Science*, still had fairly connected coauthor networks.

To understand what factors might be related to the fraction of women on an editorial board (one measure of diversity) or the average editor degree (one measure of network connectivity), we assessed correlations between various quantities of interest. We examined correlations between editor-in-chief's year of PhD degree and measures such as fraction of women on the editorial board, average editor degree, and edge density of the coauthor network and found no statistically significant correlations. We examined correlations between the number of unique institutions per editorial board member (calculated as number of unique institutions represented by editors on an editorial board divided by the number of editorial board members) and the fraction of women on the board, average editor degree, and edge density of the coauthor network. The only significant correlation was between the number of institutions per editorial board member and the average editor degree: the larger the

Figure 6. Network and Institution Graphics for *INFORMS Transactions on Education*



Panel 6A: Coauthor network with the editor-in-chief (EIC) highlighted in red.

Panel 6B: Coauthor network with women highlighted in green.

Panel 6C: Histogram of editor degrees with the EIC's position highlighted in red.

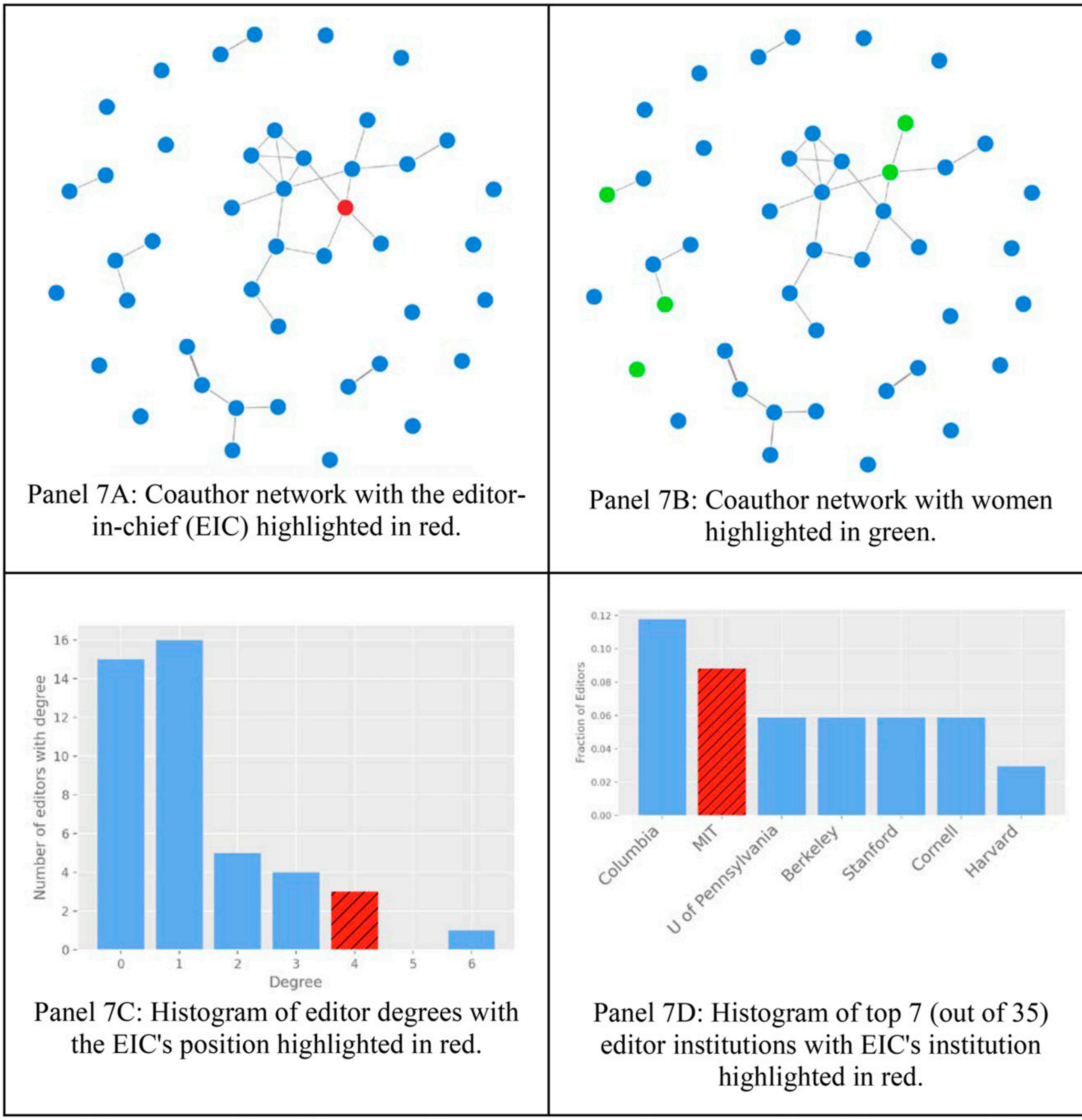
Panel 6D: Histogram of top 7 (out of 12) editor institutions with EIC's institution highlighted in red.

fraction of unique institutions represented by members of an editorial board, the lower the average editor degree (correlation coefficient −0.56, p-value 0.026). We also examined correlations between the fraction of women on an editorial board and edge density, average editor degree, and average degree of male and female editors and found no statistically significant correlations.

3.2. Analysis of Groups of Journals

A number of INFORMS journals have overlapping scope: for example, the journals *Operations Research* and *Mathematics of Operations Research* publish many similar mathematical papers. Thus, we also examined several natural groupings of journals (Table 3). Figures 18 and 19 show two of the smaller networks, where editors are colored according to their journal (and the editors-in-chief are red). The resulting edge densities (Table 3) were lower than for the individual journals, indicating that editorial board members tended to be more connected to their own editorial boards. However, there was a significant degree of cross-board connection, as illustrated in Figures 18 and 19; although not shown here, this was also true for the other four networks. In 13 of 14 cases, the degree of the editor-in-chief increased when we

Figure 7. Network and Institution Graphics for *Management Science*

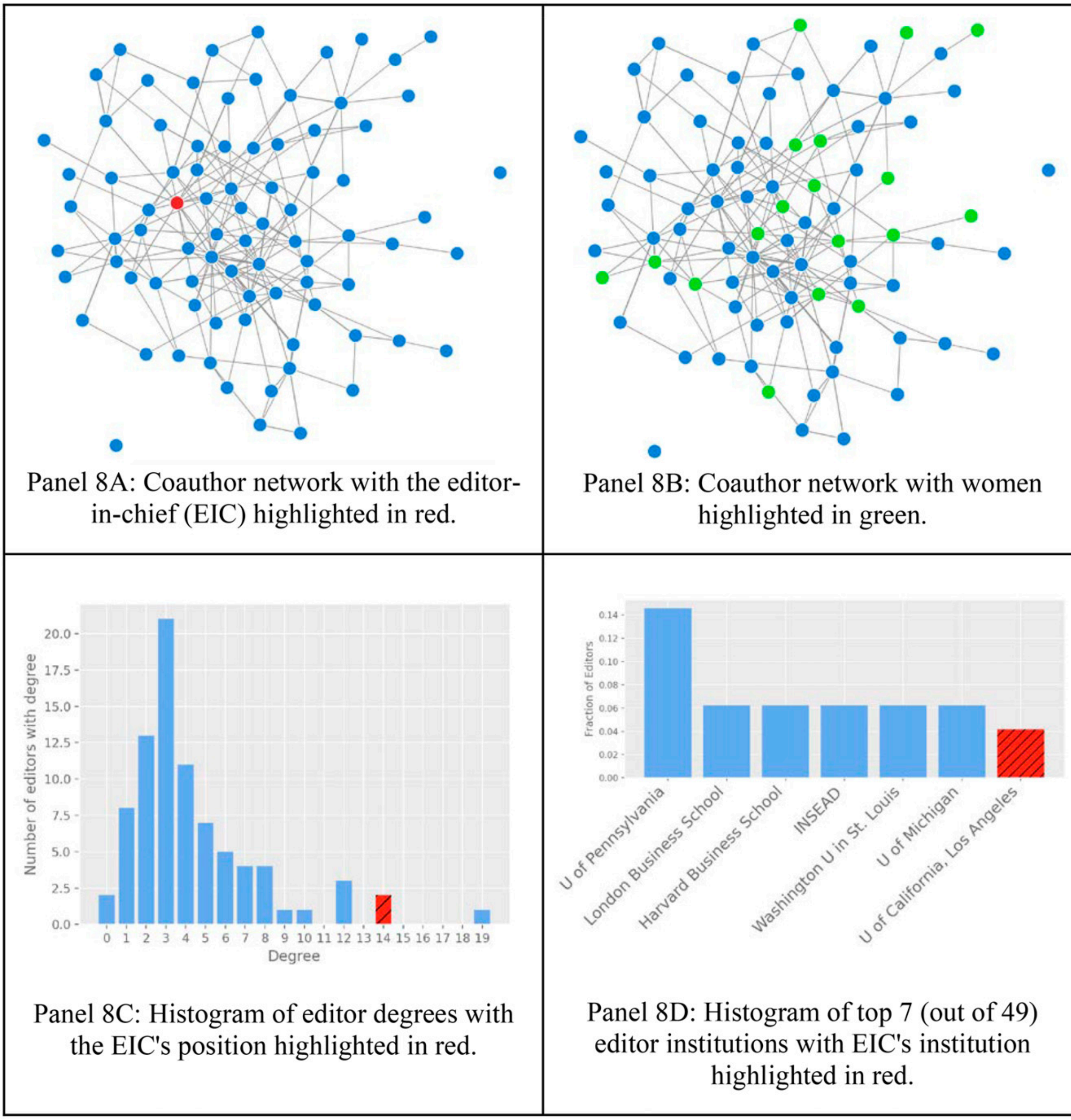


considered related journals. Finally, similar to our findings for the individual journals, there was a relatively high level of connection between editorial board members for some journal combinations.

4. Discussion

Our analysis finds that the editorial boards of the 16 INFORMS journals do not have high levels of diversity when measured by gender and racial/ethnic group: women comprise just under 20% of the editorial board members and the number of underrepresented minorities on the editorial boards is less than 1%. To put these numbers into context, recent data indicate that 26.3% of INFORMS members are women and among those members who identified a race/ethnicity, 1.0% are Black and 2.7% are Hispanic/Latino (Lloyd 2021). At a broader level, the U.S. Bureau of Labor Statistics estimates that 25.5% of individuals working in science, technology, engineering, and math (STEM) professions in the U.S. are women, and that 7.0% are Black and 13.2% are Hispanic

Figure 8. Network and Institution Graphics for *Manufacturing & Service Operations Management*

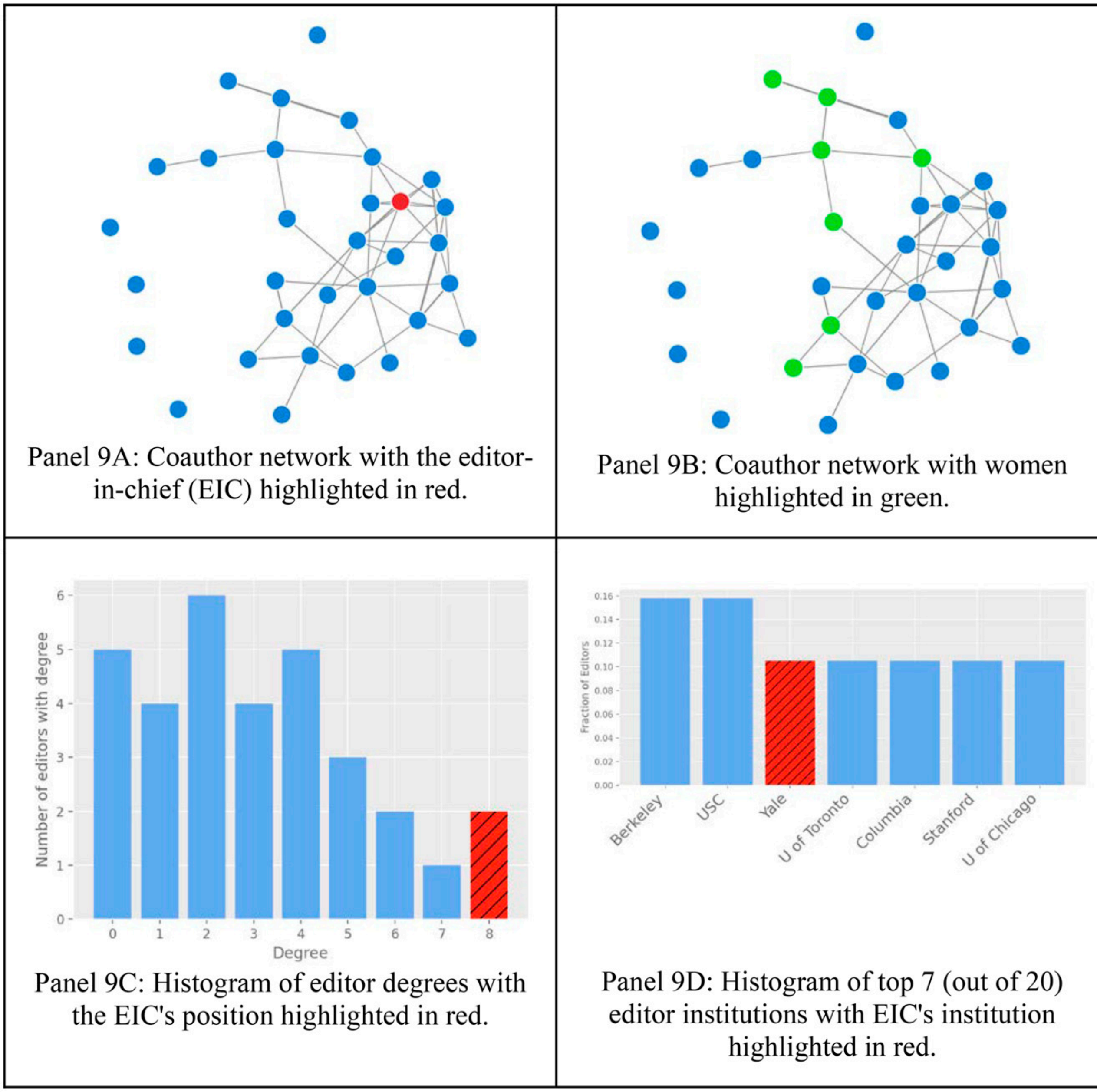


(US Bureau of Labor Statistics 2020a, b). Assuming a binomial distribution with n = 460 and $p = 0.263$ (the proportion of INFORMS members who are women), the probability of selecting 92 (20%) or fewer women editorial board members is less than 0.001.

Additionally, although the editorial board members are at a wide range of home institutions, just 10 institutions (less than 5% of the total) account for one fourth of the editors. We acknowledge that top institutions, particularly those that produce many PhD graduates and place a high value on publication and service to the profession, would naturally have higher representation on editorial boards; whether this particular ratio achieves a proper balance is something to be explored.

Our most striking findings relate to connectivity of editorial board members, as measured by coauthor relationships. For some of the INFORMS journals, the level of connectivity among editorial board members is high compared with other INFORMS journals, with very few isolated individuals, large connected

Figure 9. Network and Institution Graphics for *Marketing Science*



Panel 9A: Coauthor network with the editor-in-chief (EIC) highlighted in red.

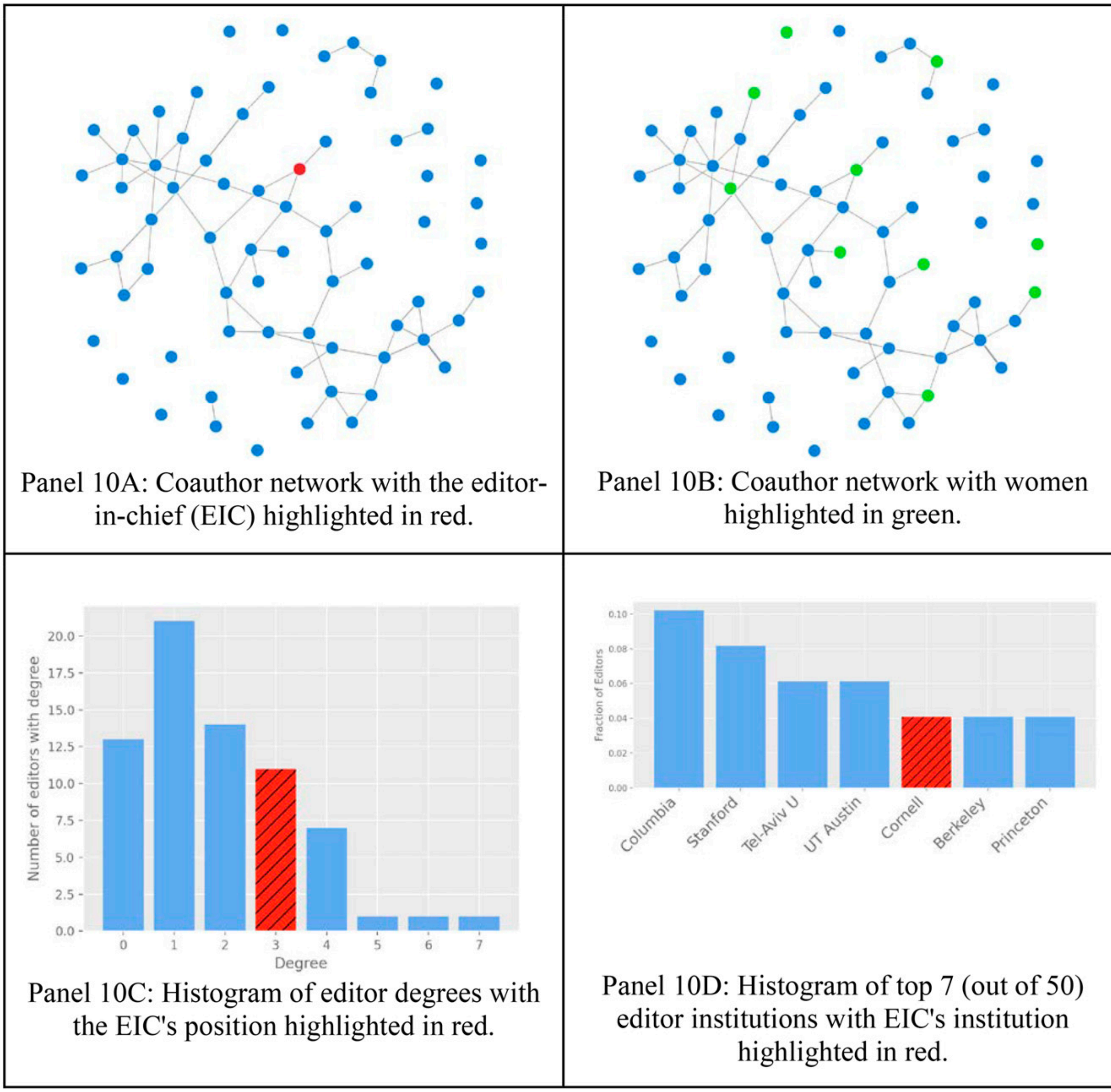
Panel 9B: Coauthor network with women highlighted in green.

Panel 9C: Histogram of editor degrees with the EIC's position highlighted in red.

Panel 9D: Histogram of top 7 (out of 20) editor institutions with EIC's institution highlighted in red.

components, and a relatively high average degree of each board member. The degree of the editor-in-chief was higher than the average degree of other editorial board members for 15 of the 16 journals. These findings suggest that the composition of journal editorial boards is in some cases rather strongly influenced by academic (coauthor) relationships between individuals, and particularly by relationships of the editor-in-chief with coauthors. We found that the coauthor networks were less connected (lower edge density) for editorial boards drawn from a larger set of institutions. We acknowledge that editorial board members are highly regarded in their field and are typically active in publishing scholarly work, so it is natural that such individuals would coauthor work with other highly regarded individuals; however, the current level of coauthor relationships among editorial board members for some INFORMS journals is high. Moreover, although it is reasonable that the editor-in-chief may have published with other editors, it may not be desirable for the editor-in-chief to have the highest level of connectivity, as this suggests that the

Figure 10. Network and Institution Graphics for *Mathematics of Operations Research*



Panel 10A: Coauthor network with the editor-in-chief (EIC) highlighted in red.

Panel 10B: Coauthor network with women highlighted in green.

Panel 10C: Histogram of editor degrees with the EIC's position highlighted in red.

Panel 10D: Histogram of top 7 (out of 50) editor institutions with EIC's institution highlighted in red.

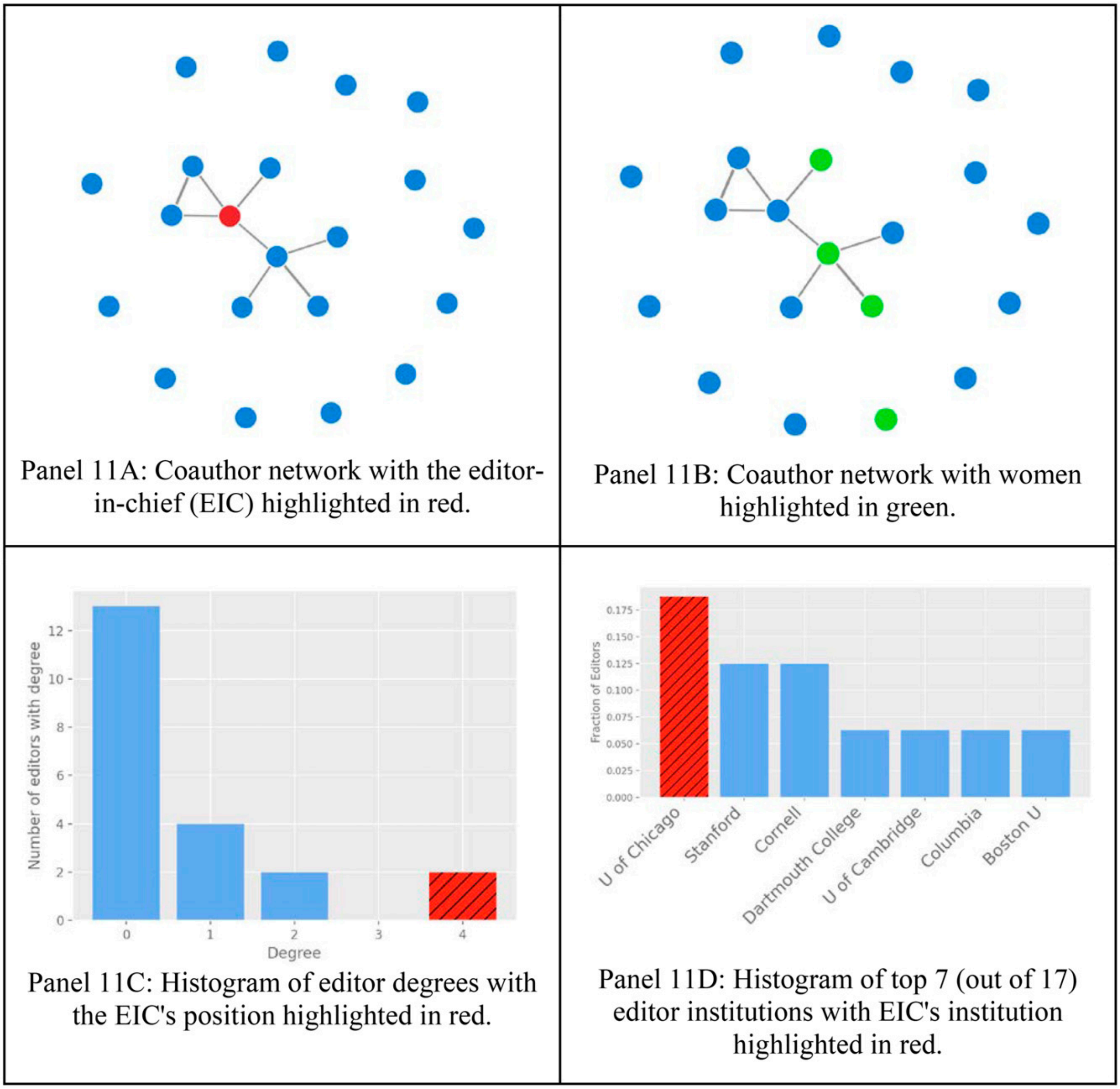
editor-in-chief has preferentially appointed editors with whom he or she has had a research collaboration. We also found that women on editorial boards had fewer connections on average than their male counterparts.

We have suggested that a high level of coauthor relationships on editorial boards could lead to a narrow editorial viewpoint. Such a link may be difficult to define and measure. We note, though, that a study of the peer review process for the U.K. Science and Engineering Council concluded that when peer reviewers have similar views (which the authors term "cognitive cronyism"), worthy work may be overlooked in areas for which there is no scientific consensus (Travis and Collins 2016). Aside from its potential impact on editorial viewpoint, a high level of coauthor relationships on an editorial board could also lead to the perception that the editorial board (and possibly by extension, the journal) is closed to individuals outside of the "in group."

Given these findings, we propose several steps INFORMS can take to increase diversity and avoid inbreeding in the editorial boards of its journals:

1. Editor-in-chief search committees should assess whether the pool of candidates is sufficiently broad

Figure 11. Network and Institution Graphics for *Operations Research*



Panel 11A: Coauthor network with the editor-in-chief (EIC) highlighted in red.

Panel 11B: Coauthor network with women highlighted in green.

Panel 11C: Histogram of editor degrees with the EIC's position highlighted in red.

Panel 11D: Histogram of top 7 (out of 17) editor institutions with EIC's institution highlighted in red.

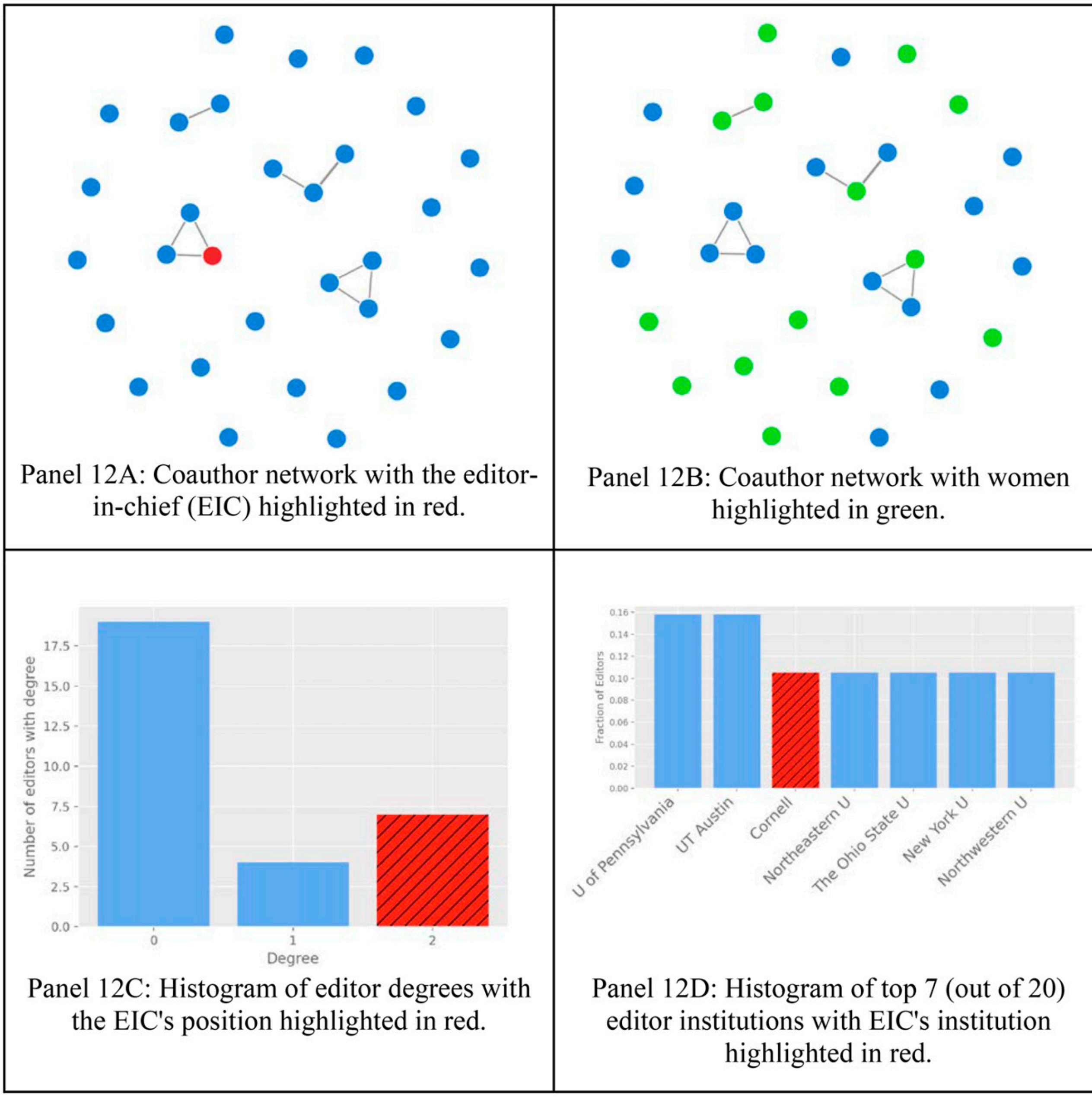
(e.g., whether the pool includes women or members of underrepresented minorities) and, if not, should determine whether other worthy candidates should be considered. They should also ask each candidate to provide a statement of how they propose to support diversity of both people and ideas on the editorial board.

2. Newly appointed editors-in-chief should review the existing editorial board to determine whether changes to the board composition could improve the journal. It could be useful to assess the fraction of women and underrepresented minority scholars in the field(s) represented by a journal when assessing the diversity of an existing editorial board.

3. When appointing new editorial board members, the editor-in-chief should ask each potential board member to identify their professional relationships (e.g., coauthor relationship) with the other current editorial board members, and should take this information into consideration.

4. Using our code, which is publicly available on GitHub at https://github.com/Arongil/Diversity-Scraper, the editors-in-chief and the INFORMS Publications Committee could assess the diversity and level of connectivity of existing and proposed editorial boards, when they are formed and at regular intervals over time (e.g., every three years).

Figure 12. Network and Institution Graphics for *Organization Science*



Panel 12A: Coauthor network with the editor-in-chief (EIC) highlighted in red.

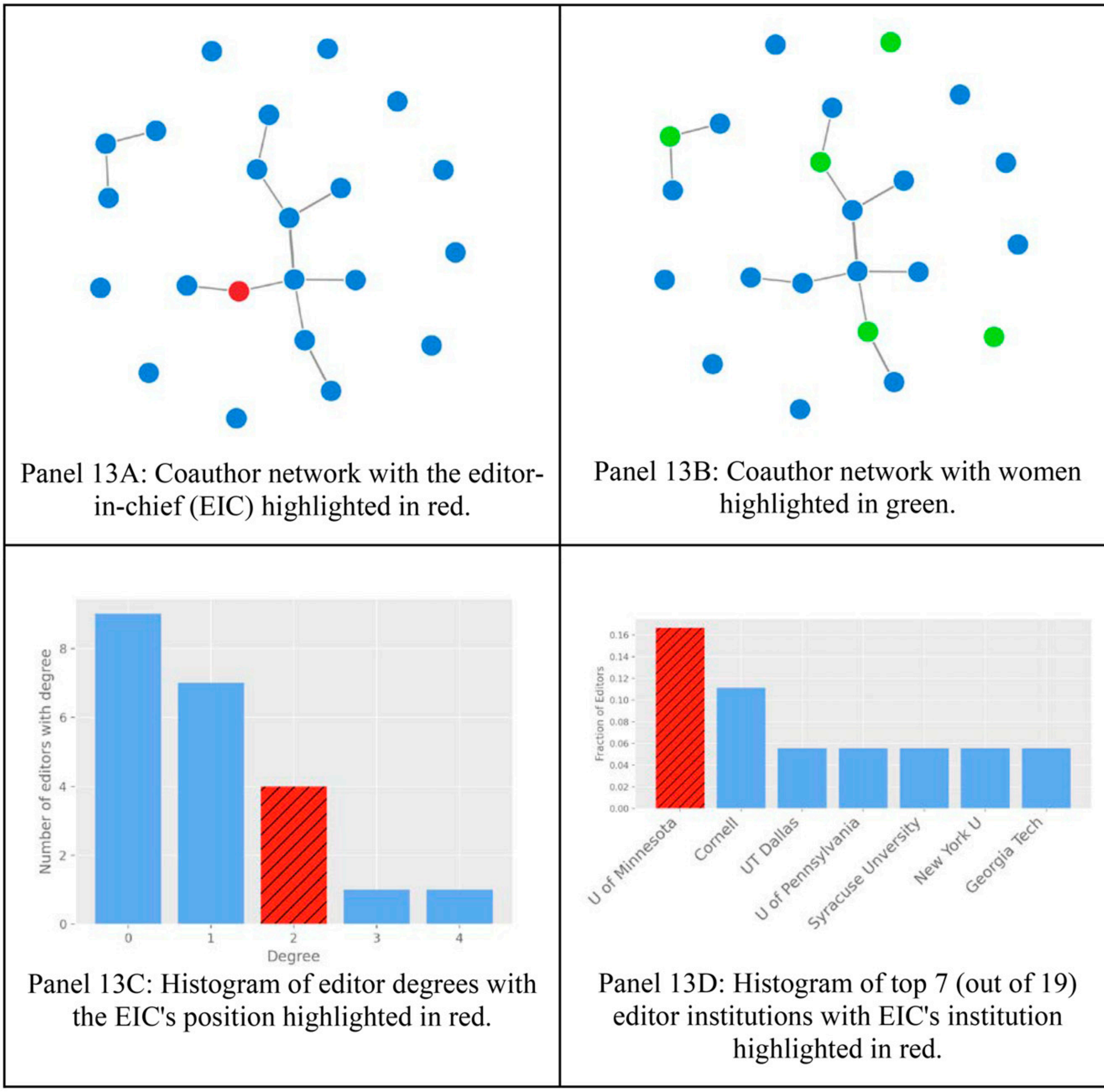
Panel 12B: Coauthor network with women highlighted in green.

Panel 12C: Histogram of editor degrees with the EIC's position highlighted in red.

Panel 12D: Histogram of top 7 (out of 20) editor institutions with EIC's institution highlighted in red.

Our analysis has several limitations. We identified coauthor relationships using Google Scholar, so our analysis is limited by the accuracy of Google's database and our attempts to include only papers reflecting true coauthorship. It was not possible to manually check all citations for all 460 editorial board members (who collectively had tens of thousands of publications listed in Google Scholar). We did perform a manual check of the findings for the 16 editors-in-chief. We found that our automated system did include some false positives (for example, a paper authored by Gordon Lee when the editor is George Lee, but both are listed as G. Lee, or a book edited by George Lee that Google incorrectly recorded as a coauthorship with the chapter authors). The automated system estimated the following number of coauthored papers for the editors-in-chief of the 16 journals, in the order listed in Table 2, with the numbers listed in parentheses being the values found after manual check: 3 (2), 6 (4), 2 (2), 0 (0), 7 (7), 2 (2), 4 (4), 14 (12), 8 (4), 3 (3), 4 (2), 2 (2), 2 (2), 4 (2), 3 (2), and 11 (11). It is likely that our automated system overcounted coauthor relationships for all editors equally often, suggesting that the ratios we

Figure 13. Network and Institution Graphics for *Service Science*



Panel 13A: Coauthor network with the editor-in-chief (EIC) highlighted in red.

Panel 13B: Coauthor network with women highlighted in green.

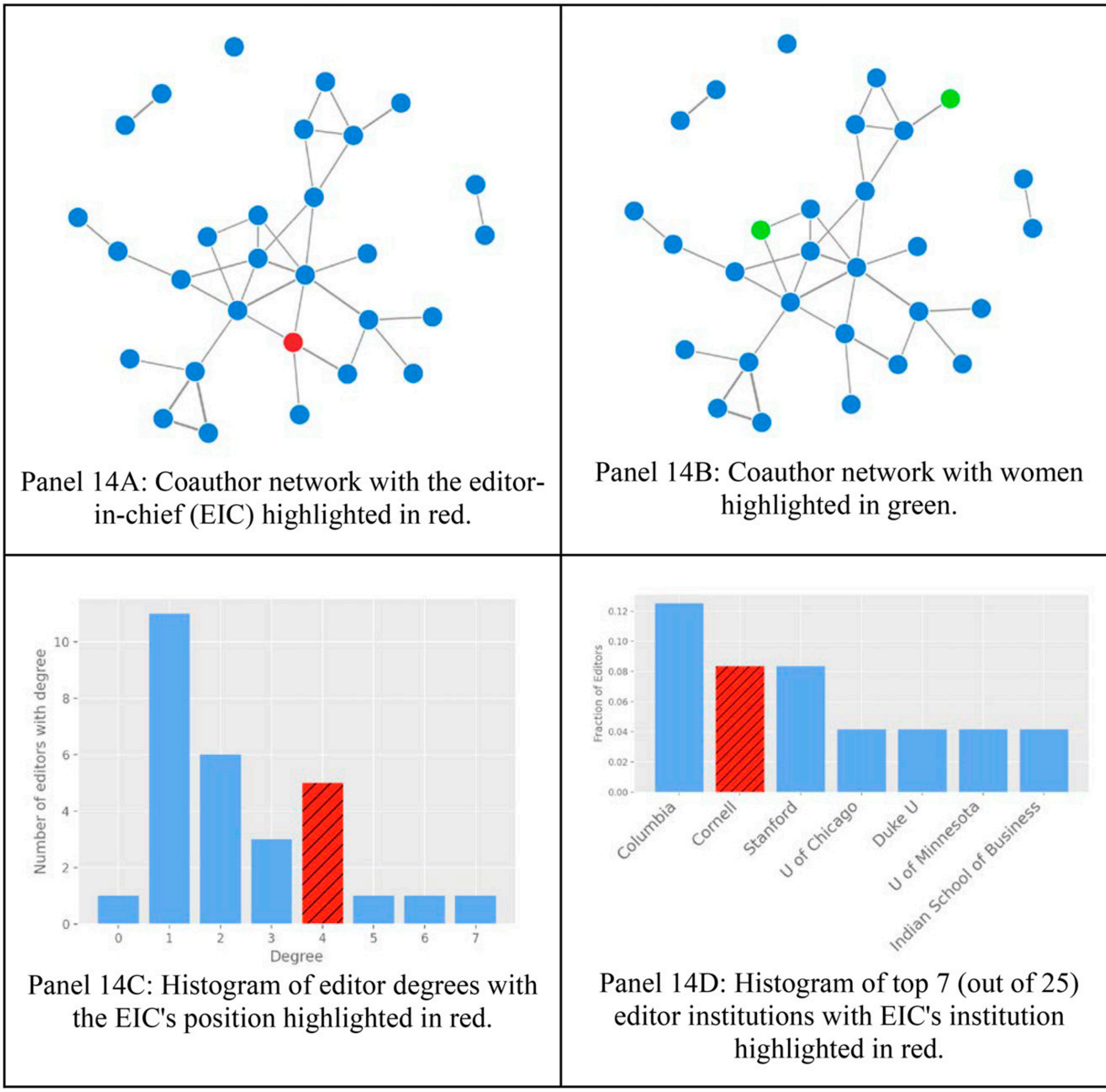
Panel 13C: Histogram of editor degrees with the EIC's position highlighted in red.

Panel 13D: Histogram of top 7 (out of 19) editor institutions with EIC's institution highlighted in red.

estimated (e.g., average degree of men versus women, average degree of editor-in-chief versus average degree of editors, relative average degree of editors in different journals) are still accurate.

We measured network connectivity using coauthor relationships and did not examine other indicators of connectivity such as dissertation advisor/advisee relationships. Advisor/advisee relationships are partially captured by the coauthor relationships that we included, but specifically identifying advisor/advisee relationships would provide further understanding of this deeper level of connectivity. We identified underrepresented minorities using a manual search of each person's name and web page; it is possible that we overlooked some individuals who identify as underrepresented minorities. Additionally, we defined underrepresented minorities as individuals who are African American/Black, Mexican American, Native

Figure 14. Network and Institution Graphics for *Stochastic Systems*



Panel 14A: Coauthor network with the editor-in-chief (EIC) highlighted in red.

Panel 14B: Coauthor network with women highlighted in green.

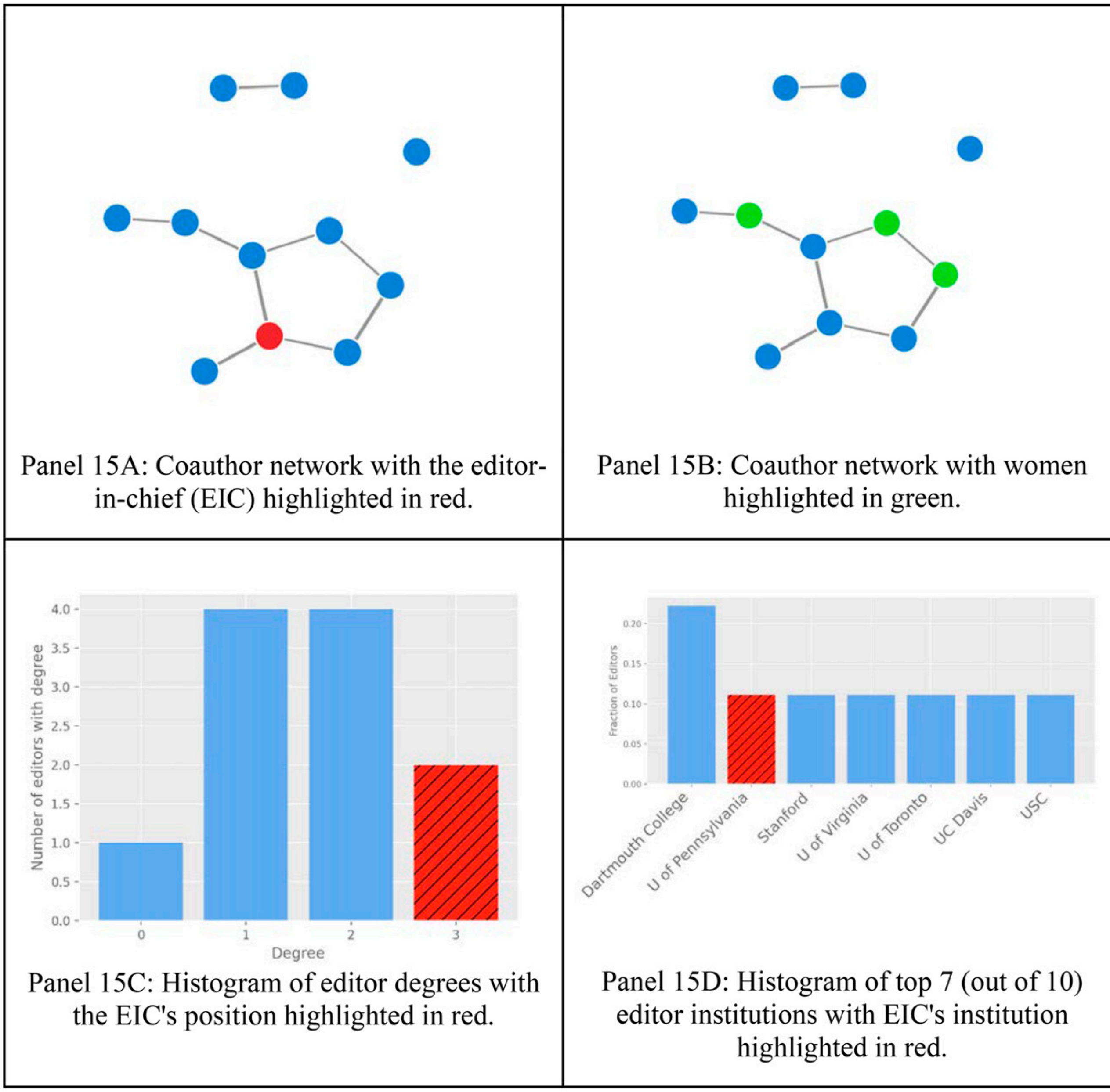
Panel 14C: Histogram of editor degrees with the EIC's position highlighted in red.

Panel 14D: Histogram of top 7 (out of 25) editor institutions with EIC's institution highlighted in red.

American or Alaskan Native, Native Hawaiian or other Pacific Islander, or biracial with one or more races from this list. Using a broader definition (e.g., additionally including Hispanic individuals born in South America, as is done for the U.S. Minority Science and Engineering Improvement Program (Cornell Law School Legal Information Institute 2021)) would lead to higher counts of individuals who are underrepresented minorities. Finally, we only examined selected measures of diversity, for example, we did not examine age, institution where highest degree was earned, or national origin of editors.

A number of promising areas for further research remain. We have examined diversity of institutions among editorial board members. A future study could examine diversity of institutions among authors publishing in a journal, as well as potential correlations between editorial

Figure 15. Network and Institution Graphics for *Strategy Science*



Panel 15A: Coauthor network with the editor-in-chief (EIC) highlighted in red.

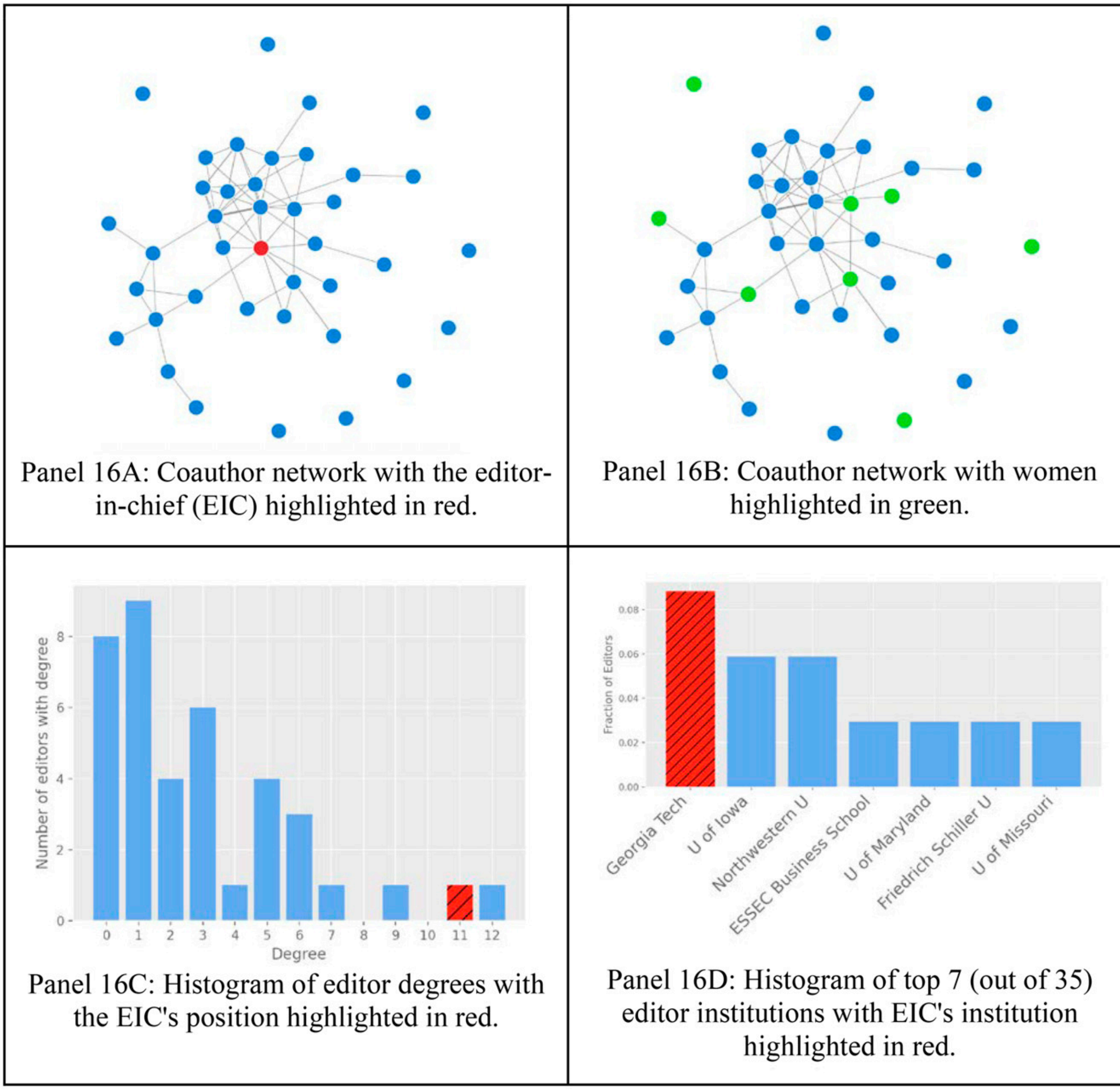
Panel 15B: Coauthor network with women highlighted in green.

Panel 15C: Histogram of editor degrees with the EIC's position highlighted in red.

Panel 15D: Histogram of top 7 (out of 10) editor institutions with EIC's institution highlighted in red.

board member institutions and author institutions. We have presented statistics for all editorial board members of each journal. Though editorial board members typically solicit referee reports and also provide their own report and recommendation, article acceptance decisions for some journals are made only by a subset of editorial board members (e.g., department editors or the editor-in-chief). An interesting area for further research would be to focus only on individuals who make acceptance/rejection decisions. We have examined editorial board diversity only for INFORMS journals. Future work could examine editorial board diversity for non-INFORMS journals where INFORMS members publish work (e.g., *Healthcare Management Science*, *Production and Operations Management*, *European Journal of Operational Research*). Finally, future work could also examine changes in the diversity of INFORMS editorial boards that have occurred since July 2020.

Figure 16. Network and Institution Graphics for *Transportation Science*



Since then, INFORMS has introduced one new journal, the *INFORMS Journal on Data Science*, and some journals have appointed new editors-in-chief or new editorial board members: for example, as of May 2021, five of the 17 editors-in-chief are women.

We conclude from our analysis that the editorial boards of many INFORMS journals have low levels of diversity in terms of gender and underrepresented minorities, and some have highly connected editorial boards, suggesting influence of an in crowd of like-minded individuals. INFORMS and the editors-in-chief of its journals can and should work to end this state of affairs by broadening diversity on the editorial boards of its journals and, to the extent possible and reasonable, by appointing individuals who are not coauthors with other editorial board members. In this way, INFORMS journals can support a diversity of backgrounds and views, thereby enabling the publication of a broader range of ideas and invigorating academic discourse in our profession.

Figure 17. Home Institutions of Editorial Board Members for the Top 15 Institutions Ranked by Number of Editors

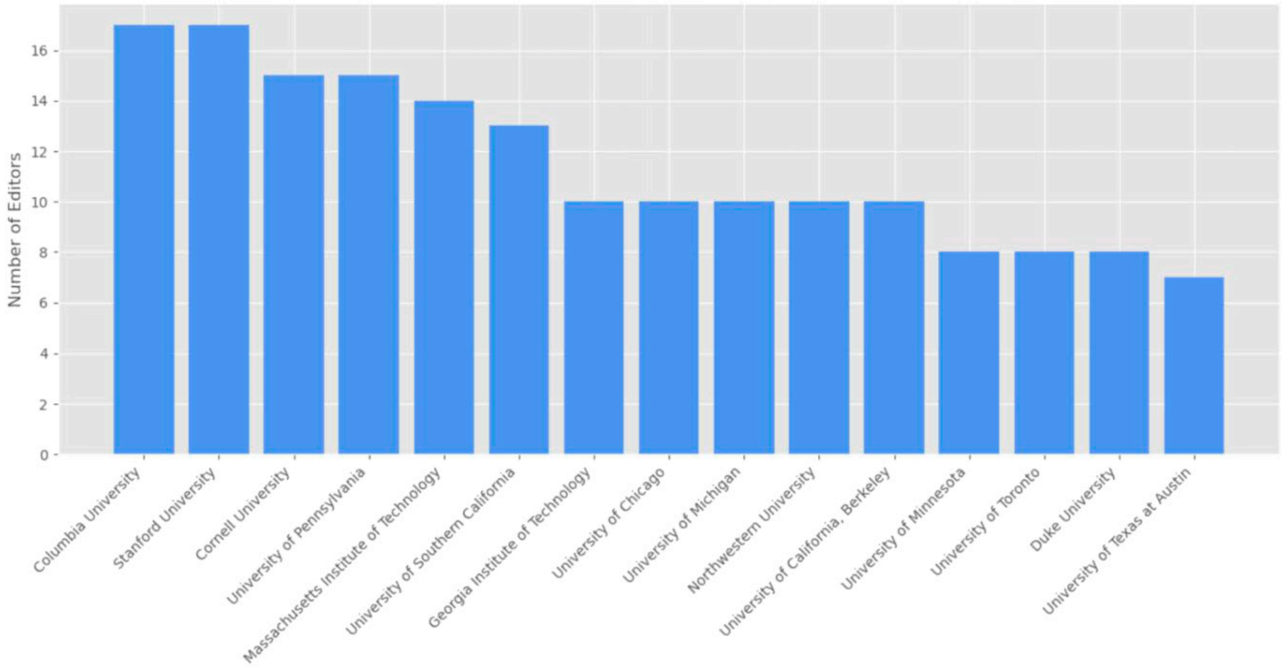
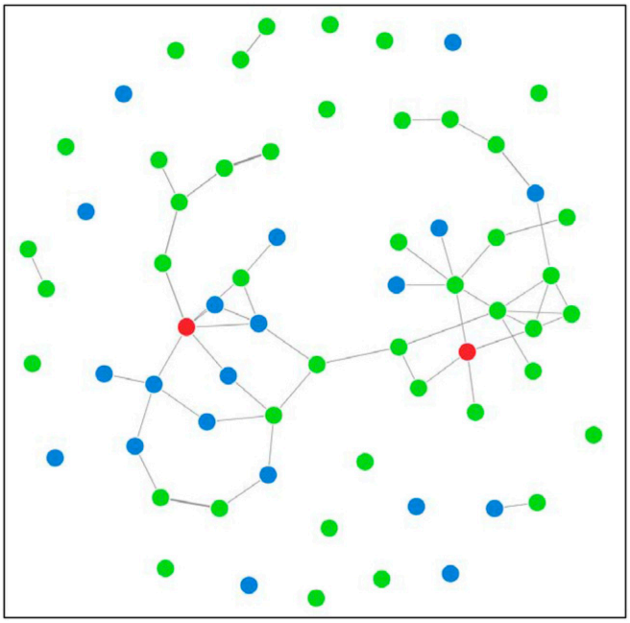
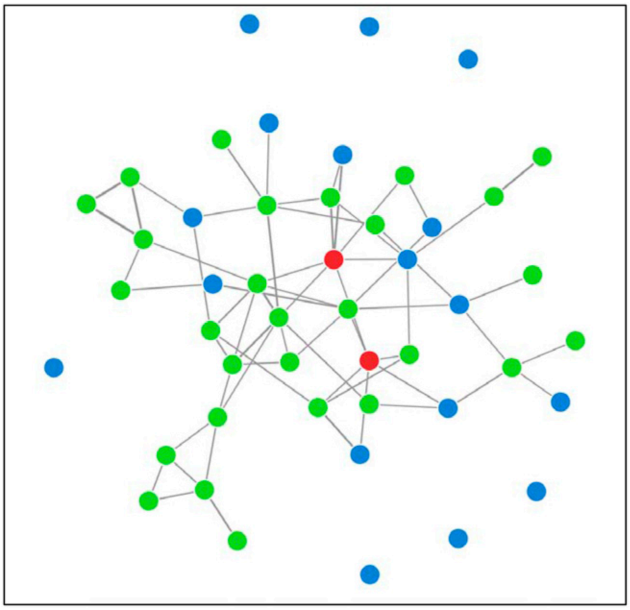


Figure 18. Network of Connections for the Editorial Boards of *Operations Research* (in Blue) and *Management Science* (in Green)



Note. The two editors-in-chief are shown in red.

Figure 19. Network of Connections for the Editorial Boards of *Operations Research* (in Blue) and *Stochastic Systems* (in Green)



Note. The two editors-in-chief are shown in red.

Table 3. Summary Statistics: Editor and Network Characteristics of Combined Journals

	Editor characteristics			Network characteristics							
Journals	Total number of editors	Number of women editors	Number of URM editors	Average degree	Average degree: Men	Average degree: Women	Degrees of editors-in-chief	Maximum degree	Number of isolated nodes	Number of connected components	Edge density
MS+MSOM	126	23	0	4.4	4.5	4.0	10, 18	22	13	15	0.035
MS+OR	65	9	0	1.6	1.5	1.8	4, 6	6	20	24	0.025
MS+MSOM+OR	146	26	0	4.4	4.5	4.2	10, 19, 10	22	16	18	0.030
MOR+OR	88	14	1	2.1	2.1	2.2	6, 7	9	16	18	0.024
IJOpt+MOR+OR	102	16	1	2.7	2.7	2.6	10, 8, 9	11	13	15	0.027
OR+StochSys	47	5	1	2.7	2.7	2.4	6, 7	7	7	8	0.058

Notes. IJOpt, *INFORMS Journal on Optimization*; MOR, *Mathematics of Operations Research*; MS, *Management Science*; MSOM, *Manufacturing & Service Operations Management*; OR, *Operations Research*; StochSys, *Stochastic Systems*; URM, underrepresented minority.

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L. Newhouse performed all technical analyses including development of computer code, web scraping, network creation, and calculation of metrics. M. Brandeau supervised the technical analyses, interpreted the findings, and developed the recommendations. The authors thank their colleagues and the anonymous reviewers who provided helpful feedback on earlier versions of the manuscript.

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