Article:
Burgess, T, Grimshaw, P, Huaccho Huatuco, L et al. (1 more author) (2017) Mapping the Operations and Supply Chain Management field: a journal governance perspective. International Journal of Operations and Production Management, 37 (7). pp. 898-962. ISSN 0144-3577

https://doi.org/10.1108/IJOPM-01-2016-0043

Emerald International Journal of Operations and Production Management

Mapping the Operations and Supply Chain Management field: a journal governance perspective

Journal:	*International Journal of Operations and Production Management*
Manuscript ID	IJOPM-01-2016-0043.R1
Manuscript Type:	Research Paper
Keywords:	Journals, Networks, governance, academic communities

Introduction

Operations Management (OM) as a management field dates back at least a century (Sprague, 2007), while the related area of Supply Chain Management (SCM) has developed rapidly and more recently with its genesis often identified as the 1980s (Singhal and Singhal, 2012). The relationship between the two is such that academics increasingly refer to the operations and supply chain management (OSCM) field (Roth et al., 2016 Accepted on-line), although the nature of the relationship between the two elements is subject to debate. The aim of this paper is to investigate the diversity of this unified ecosystem both at the level of intellectual structure and of the demographics of individual academics. In so doing we aim to shed light on the relationships between SCM and OM, and on the gender, business school affiliations and geographical distributions of academics involved in journal governance.

Although past contributors to OSCM research demonstrated the dynamism of the field's intellectual structure (e.g. Pilkington and Meredith, 2009; Shiau et al., 2015), they paid scant attention to charting the academic communities that form the collective and fuel its vibrancy. Rather than adopting a social perspective, researchers concentrated on mapping intellectually their domains with studies focused on the knowledge content of journals. Our approach captures the social communities comprising the OSCM field and underpinning the field's knowledge structures. Using social network analysis (SNA) (Wasserman and Faust, 1999; Scott, 2003) we connect OSCM journals, academics and institutions by analysing the interlocking membership of journal governance systems referred to as editorial advisory boards (EABs). The study addresses the research question: how do the interlocking EABs of OSCM journals map out the field's diverse academic communities and how demographically diverse is the field and its communities?

Thirty eight journals representing the OSCM field are allocated to seven communities by SNA of EAB members. We contrast the social structure of communities with prior studies of intellectual structure. These communities form two larger groupings of a core and periphery in the social network. Our analysis identifies the SCM community as a substantial constituency occupying a key position near the centre of the modern OSCM field; but surprisingly this community includes EAB members from the Journal of Operations Management. We show the OSCM field's lack of diversity given its domination by males affiliated with business schools and with USA-based organisations.

First we deal with the literature on academic fields and on mapping their intellectual structures, making some general comments before paying particular attention to previous

studies in OSCM. Next we outline the SNA methodology and how we collected the data. Then we present our findings, discuss these and conclude by covering study implications, limitations and suggestions for further research.

Literature Review

First some general remarks are made about academic fields and how to map their intellectual structures before concentrating on the OSCM field. These comments cover studies that identify a field's intellectual structure by linking together the knowledge content of published artefacts and examining such as the frequency that topics occur in the knowledge structure. An alternative to this knowledge-content-perspective involves studying the social connections between academics, for example through co-authoring publications or co-attending conferences. For such a grouping of connected academics we use the term "community". In this study we are interested in the communities within an academic field; such an individual community can combine a single discipline, multiple disciplines – or even simply an element of a discipline.

Academic Fields

According to Jenkins (2007 p. 84) "A field, in Bourdieu's sense, is a social arena within which struggles or manoeuvres take place over specific resources or stakes and access to them". Becher and Trowler (2010) in their landmark study view academic fields as often comprising single or multiple disciplines; and go on to link their cognitive and social aspects. Whitley (2000), in his influential work on analysing the intellectual and social organisation of the sciences, uses the term "field" for management and business studies; an area constituted by multiple disciplines; and identifies areas such as Operations Research (OR), and therefore presumably OSCM, as sub-fields. He identifies management and business in recent times as becoming more fragmented and diverse – a view that is added to by the many critiques of the state of this academic area (e.g. Hamel, 2007). Whitley recognises various factors that have allowed specialisms to flourish; these factors include the continued expansion of higher education systems and the reduced influence of US-based companies and related economic systems. In his terms Management Studies is a fragmented adhocracy where the sub-fields have low strategic and functional dependence; i.e. areas such as OSCM tend to be only loosely connected to other areas. Because OSCM is the focus of this paper, for ease of description we describe it as a field and the communities comprising OSCM as sub-fields.

We acknowledge the questions of whether OM or SCM or related sub-fields are disciplines (e.g. Pilkington and Liston-Heyes, 1999; Harland et al., 2006) but do not pursue these here.

Mapping intellectual and social structures

In academia many researchers have studied the intellectual structure of their fields and disciplines; and such studies appear to be carried out more frequently in the social sciences as fields mature and research styles become more reflexive. Often researchers analyse the content of academic journals to establish how knowledge in a particular academic domain is partitioned and connected. Although knowledge also resides in artefacts other than journals, e.g. conference papers, books, etc.; many fields and disciplines prioritise journal articles over other knowledge sources. Past approaches to analysing such knowledge sources have included subjective classification of journal content, citation/co-citation analysis (CCA) (Cawkell, 2000) and, more recently, forms of co-word analysis, e.g. latent semantic analysis (LSA) (Larsen et al., 2008). These study types select their base data from various sources within journals including: titles, abstracts, keywords, article content, and citations. Related studies of journals are often, and increasingly, carried out to determine how community members rank and rate their journals. For example, Barman et al. (2001) carried out a survey of OM academicians to ascertain how they rank the quality and relevance of OM journals.

One way of illuminating how individual authors, and groups, link together to form academic communities is to carry out co-authorship studies of journal papers (Behara et al., 2014). Recently, Burgess and Shaw (2010) and Baccini and Barabesi (2010) introduced a new approach to studying academic communities by applying SNA (Wasserman and Faust, 1999; Scott, 2013) to data for academics occupying formal roles in journal governance systems. Burgess and Shaw's study examined the links between the main academic fields comprising management and business by investigating the Financial Times 40 list of top journals (since then the Financial Times list has expanded to 45) while the study of Baccini and Barabesi focused on the single field of Economics.

The rationale for studying EAB members stems from their recognised role as academic gatekeepers. Individuals are invited on to EABs for a variety of reasons but generally-expressed views suggest that a major reason is that they are seen as high status individuals within the journal's disciplinary or topic catchment area (Bedeian et al., 2009) and therefore suitable gatekeepers for the journal's academic values. Clearly individuals who serve on the same EAB are linked by their association with the journal and with aspects such as the journal's academic interests. Where an individual serves on two or more boards then

this can be taken to link the boards (and journals) by virtue of them possessing similar academic interests. Such links can be used to structure the field into a network of various communities derived from the degree of similarity between the board members (and journals). This type of journal study focusing on EAB interlocks, is analogous to the study of companies through board interlocks; an approach that has been around for many years (for a review see Mizruchi, 1996). The affinity described above between EAB members can be explained theoretically in a number of ways. In a fundamental sense the concept of homophily (McPherson et al., 2001) can be invoked from Social Network Theory, i.e. where social actors prefer to link with other actors that they see as similar to themselves. In a more-sociologically-specific manner we can use the Bourdieu-informed approach adopted by Burgess and Shaw (2010). Briefly, in this perspective academic fields are socially stratified with a self-reproducing elite (the editorial advisory board) dominating the non-elite members of the field.

This study is focused on the broad editorial group that is connected to a journal rather than in a narrowly-focused editorial team (Burgess and Shaw, 2010). While not denying the particular influence of the editor-in-chief, or a small editorial team, this focus reflects that SNA is used in this study to trace the connections linking broad communities within a particular academic field.

Intellectual structure of operations and supply chain management

The OM field grew historically out of Production Management and Factory Management whose origins can be traced back to the start of the twentieth century (Meredith and Amoako-Gyampah, 1990; Bayraktar et al., 2007; Singhal et al., 2007; Sprague, 2007; Piercy, 2012). Along the way OM has been infused by other areas such as service (Levitt, 1972; Levitt, 1976), quality, computers, just-in-time (JIT), materials requirements planning (MRP), and supply chain management (SCM) (Bayraktar et al., 2007). Since SCM's origins in the 1980s (Singhal and Singhal, 2012), the relationship of SCM and OM has been subject to discussion and debate. Some see SCM as the latest area to integrate within OM while others might see the future as OM being incorporated within SCM. In this paper we adopt a perspective that brings OM and SCM together in the ecosystem of operations and supply chain management (OSCM) (Roth et al., 2016 Accepted on-line).

The evolution of OSCM can be studied by mapping the field's intellectual structure, as discussed in general in the earlier section. Buffa (1980) is credited with early attempts to describe OM's intellectual structure. Further literature has accumulated since this early

contribution and Table 1 contains some influential studies that typify the accumulated literature on the structure of the OSCM field and its evolution. These studies include reviews of academic articles and wider literature such as books (Buffa, 1980; Mabert, 1982; Amoako-Gyampah and Meredith, 1989; Barman et al., 1991; Neely, 1993; Pannirselvam et al., 1999) and surveys of academic opinions (Miller et al., 1981; Voss, 1984; Meredith and Amoako-Gyampah, 1990; Scudder and Hill, 1998). In recent times more 'scientific' methods have been deployed; in particular citation analysis (CA) and, more latterly, co-citation analysis (CCA) have figured widely as approaches (Goh et al., 1996; Vokurka, 1996; Pilkington and Liston-Heyes, 1999; Vastag and Montabon, 2002; Pilkington and Fitzgerald, 2006; Petersen et al., 2011). Even more recently other approaches have been used, e.g. LSA which Kulkarni et al. (2011) used to identify the major topics and methods in IJOPM articles over a thirty year period.

Table 1 about here

Analysis of these example studies suggests they focus typically on classifying the knowledge content of academic articles into representative categories; with a key interest in observing how the field has changed over time (e.g. see Buffa, 1980). The differences in study methods and data sources used, coupled with the different times of the various studies mean they differ in the knowledge groups identified. Nevertheless, some common strands can be observed in studies of the last two decades. The main knowledge groups have included: manufacturing strategy, planning and control (particularly at the tactical level), performance measurement, product and process design, lean, quality and supply chain management (SCM). Over the last two decades topics such as tactical planning and control, and manufacturing strategy have reduced in popularity while SCM and quality management have increased. Notwithstanding these changes, manufacturing strategy was recently still the main preoccupation of journal articles (Pilkington and Meredith, 2009). But a key point is the perceived increase in importance of SCM (Pannirselvam et al., 1999; Chopra et al., 2004; Pilkington and Fitzgerald, 2006; Craighead and Meredith, 2008; Pilkington and Meredith, 2009; Petersen et al., 2011; Singhal and Singhal, 2012). In their contribution Singhal and Singhal (2012) point to theoretical explanations that can be called upon to explain how a particular area of new knowledge, such as SCM, can appear, grow and potentially supplant the existing dominant area (Eldredge and Gould, 1972; Kuhn, 1996).

Social structure of operations and supply chain management

While knowledge content of journal articles is important to know about and to track over time, academic articles are produced by social processes which themselves are important to observe and understand since they can explain the unfolding of knowledge content, or any ebbs and flows that occur. Such a view is consistent with the work of Whitley (2000) on intellectual and social organisation but is also raised by OSCM contributors. Saladin (1985) suggested a wider view of OM should reflect this social nature and include the influence of academics and practitioners, while Goh et al. (1996) outlined the need for any discipline to examine its communications.

Methods such as CA and LSA are based on citations that occur usually within a narrow group of journals and point to articles published in a wider spread of journals. Although CA is not designed to address the influence of social groups within an academic field, and the focus on a narrow spread often means that studies do not address a whole field; the method provides useful evidence of 'social linkages' between authors (Vastag and Montabon, 2002 p. 114). Pilkington and Meredith (2009) combined citation analysis, and co-citation analysis, with SNA to visualise the OM community, thus pursuing the idea of OM academic influence being shaped by distinct social groups. Unlike previous attempts which sought to outline key topics, categories or most important journals, Pilkington and Meredith attempted to map more fully the field's intellectual structure. They used citations to visualise the major knowledge groups and to map the development of citation and research groupings over time.

However, although the work of such as Pilkington and Meredith focuses on links between OM authors; little work, if any, has examined the social links between journal EABs in OSCM. Clearly the two are linked; the editorial board influences which authors are published in a journal; while authoring articles in a journal can lead to membership of the EAB. However as indicated earlier, SNA of EAB linkages is an alternative and growing method of structuring a field; and one that focuses on the gatekeepers rather than the authoring community within a field.

The previous sections have demonstrated that SCM is an area of growing importance in the field's intellectual structure. This raises queries allied to how SCM figures in the field's social organisation. For example how is SCM structured as a community and how does it relate to other communities within the field – i.e. to what extent does it contribute to forming a diverse or a uniform OSCM field? One of the key concerns with field structures is how diverse they are; for example, questions can be asked such as what might be the volume and variety of knowledge topics within a field or how many separate communities can be

identified? In fields other than OSCM, e.g. Management Information Systems (MIS), the intellectual diversity of the field has been a more controversial topic and featured substantially in the MIS literature. In a recent piece celebrating 50 years of the MIS field, Hirschheim and Klein (2012 p. 193) commented that diversity "is widely accepted as a hallmark of the field". Diversity covers a wider context than just knowledge structures (intellectual diversity); as McGrath et al. (1995) point out, one of the diversity categories is demographic characteristics such as: age, ethnicity, sexual orientation, physical status, religion and education. However the diversity of the intellectual structure connects to demographic diversity of the field and of the communities, i.e. aspects such as gender or geographical affiliation of the individual academics conditions in some way their knowledge interests. Gender diversity in academia has attracted the attention of researchers; and commentators such as Metz and Harzing (2009) have specifically examined gender diversity in editorial boards of management journals. Similarly geographic diversity in editorial boards has also been studied (Harzing and Metz, 2012a; Harzing and Metz, 2012b).

To recap, the study's primary research question is: how do the interlocking editorial advisory boards (EABs) of operations and supply chain (OSCM) journals map out the field's diverse academic communities and how demographically diverse is the field and its communities?

Methodology

For the study data set we took the 40 journals listed in version 4 of the Academic Journal Quality Guide of the UK Association of Business Schools (ABS, 2010) under the category of Operations and Technology Management. However, the sample was reduced to 38 since two journals were duplicated under different names (see Table 2 for the full list of 38 journals included in the study). Details of the journal's EAB members were extracted from the journals' websites; this included name, editorial board role, gender, and organisational and departmental affiliations. The organisational affiliation was used to assign a geographic location to the individual while the departmental affiliation was dichotomized in to business school or not. The data were cross-checked against institutional and personal websites, updated as necessary, and consolidated into an Excel file. Various checks were made of the overall database and preliminary statistical analysis carried out. For the social network analysis three two-mode data files were extracted from the Excel spread-sheet: individuals affiliated to journals (through EAB membership), individuals affiliated to organisations (through employment) and journals linked to organisations (through the organisational

affiliation of the EAB member). These three data matrices were imported into UCINET (Borgatti et al., 1999) and converted for analysis as one-mode data tables (journals, academics and institutions). NETDRAW was used to visualise the data in network diagrams. Various SNA measures were determined including network density, node degrees and between-ness. A hierarchical cluster analysis was carried out along with a multi-dimensional scaling plot and these were used to identify the communities comprising the field. The analysis methods are covered in more depth in the results.

Table 2 about here

Results

The 38 journals provided data for 1,902 EAB memberships that were occupied by 1,533 individuals in 708 organisations located in 59 countries. Table 2 shows that just under half (47%) of the journal's publishers were UK-based while 31.6% had publishers based in other European countries. US societies/ publishers controlled approximately 21% of the journals. Males occupied over 88% of the memberships, and the majority of occupants (i.e. 91%) were located in universities or similar higher education institutions with the remaining 9% affiliated to businesses. Forty nine per cent of the total was affiliated to business schools and 39% were affiliated to organisations located in the USA. EAB sizes ranged from 20 to 177 with a mean of 50 members per journal (see Table 3[1]). The mean "age" of the journals since their establishment was 30 years and the mean ABS score[2] for journal quality was 2.

Table 3 about here

Journal network structure

Figure 1 presents a sociogram of the journal network, i.e. a standard SNA (Wasserman and Faust, 1999; Scott, 2013) method of presentation,. Each circle in the diagram is a node that represents a social actor, in this case a journal. A line connecting two nodes (journals) is a relational tie (Wasserman and Faust, 1999) and in this case signifies at least one person who sits on the EABs of both journals, i.e. a board interlock. Hence this is a binary (or dichotomized) network since a link either exists or it does not. A line in this network diagram is referred to as undirected tie since the lines do not portray any direction to the association between the nodes. A journal with a high number (degree) of ties to other

[1] Note that to save space the table is arranged using groupings that are explained later in the analysis.
[2] The ABS scores are on a 1 to 4 scale where 1 represents modest standard journals and 4 represents top journals in their field.

journals is positioned toward the centre of the sociogram, while those with few ties are located toward the periphery of the diagram. The software used to plot the sociogram applies a standard algorithm to position the nodes according to their centrality. In social network theory centrality is important (Scott, 2013). In this study high degree centrality means that the journal has EAB members who also sit on many other EABs thus generating many opportunities for information to be exchanged with these other journals and for such as innovatory ideas to be exchanged. Centrality often confers other advantages such as high status. This can be seen in Figure 1 where the shape of the journal node, and its colour, represents its ABS score (see legend). It appears that the higher the journal's ABS score then the more central its position in the network.

Figure 1 about here

Two journals (HCI and IJTM) are not connected to the OSCM network (these are termed isolates) while two other journals (JPA and IJTMSD) are "pendants", i.e. each only connects to one other journal. The Journal of Operations Management (JOM), with the highest number of ties to other journals (23 out of the maximum 37), lies at the centre of the network. JOM is also the highest ABS scoring journal in the network with the maximum score of 4. The density of this binary network is 27.7%, i.e. approximately a quarter of all possible connections between journals are present.

The analysis so far has used degree (the number of other nodes that the individual node connects to) as the measure of centrality; however other centrality measures can be applied (Scott, 2003). Between-ness is another measure that is often used. A node with a high between-ness value signifies that the journal has a strong role as an intermediary that links other journals together. According to Wasserman and Faust (1999) between-ness values indicate the extent of gatekeeping. While JOM has a high between-ness value, two journals (JBL and JPSM) stand out as having even higher between-ness values but without possessing high degree values (see Table 3). This suggests that, although not positioned centrally, the two journals occupy key brokerage roles in the network, i.e. their board members enable communication paths that link pairs of other journals together.

The journals can also be depicted as a valued network where the number of EAB members shared by each pair of journals is taken in to account in analysing the network (this approach is applied later in the analysis).

Correlation between study variables

Table 4 presents the Pearson bivariate correlations between the variables listed in Table

3. The size of the EAB is significantly correlated with four other variables. The higher the proportion of board members affiliated to Business Schools and to USA-located organisations then the larger the journal's board membership. The larger the board then the more likely the journal is to be situated centrally in the network and to have a high ABS score.

Table 4 about here

Grouping journals into communities

The journals were grouped into clusters based on a hierarchical cluster analysis (HCA) of the network connections (Figure 2) and a multi-dimensional scaling (MDS) plot (Figure 3). We refer to these clusters as communities since they represent clusters of linked individuals within the social network of EAB members. These communities form the sub-fields of the overall OSCM field. The allocation to clusters was achieved by inspecting the HCA plot for groups comprising four or more journals that clustered in close proximity and then confirming this proximity on the MDS plot. We draw attention to one particular allocation that might seem counter-intuitive, namely the allocation of JOM to the group connected with Supply and Logistics. On the HCA plot JOM can be seen to be firmly embedded within a group of journals that relate to SCM. The identified clusters were named by taking note of the titles and aims of the journals comprising the cluster. For example, the naming of the Supply and Logistics cluster of eight journals was informed by four out of the journals having titles containing the word "Logistics" while three had "Supply" in their title. The clustering and naming was also informed by the authors' views which were grounded in their experience of the OSCM field. Seven out of the 38 journals could not be easily allocated to any of the six clusters given their location on the HCA plot and were therefore allocated to a seventh group of miscellaneous journals. These seven journals included the two pendants and two isolates mentioned earlier in connection with Figure 1. Figure 3 shows the MDS plot with the boundaries of the six main communities superimposed on the diagram.

Figure 2 about here

Figure 3 about here

Five members of the miscellaneous group are not shown on the MDS plot (Figure 3) since they feature as outliers outside of the plotted area, a visual indicator of their poor connection with the other journals. The names of each cluster, or community, reflect the perceived interests of the journals comprising the cluster and are as follows: (i) computers & production (C&P), (ii) manufacturing & services (M&S), (iii) miscellaneous (M), (iv) operations, performance & systems (OP&S), (v) project & engineering management (P&EM), (vi)

quality & process (Q&P) and (vii) supply & logistics (S&L). In Table 3 various characteristics are shown for the individual journals along with their allocations to their communities; while Table 5 shows the journal characteristics aggregated against these communities.

Table 5 about here

The results of the ANOVA (Table 5) show that the communities are similar in terms of journal characteristics such as percentage of EAB members that are male, percentage affiliated to Universities and percentage affiliated to US institutions. The clusters are also similar in terms of the age of their journals, i.e. the time since the journals were established. However, a good number of statistically significant differences exist between the communities including size of EABs, degree, between-ness, business school affiliation, and ABS scores. Next we make some comments against each of the communities.

Computers and production (C&P)

The five journals in this group (CIE, IJCIM, IJPE, IJPR and PPC) have a high mean ABS score (2.6), substantially-sized boards and the highest mean degree of any community (15.4), i.e. this group contains journals with the highest number of connections to other journals. The group has the highest percentage male membership (94%). The individual EAB members in this group tend not to be affiliated to business schools; i.e. 72.7% are affiliated to alternatives such as engineering faculties, and the individuals tend not to be drawn from USA-based institutions. Three out of the five journals are in the Elsevier stable with the Netherlands as the home base.

Manufacturing and Services (M&S)

This community is composed of four journals (JFMS, JOS, MSOM and POM). Two belong to a German publisher and the other two to a publisher in the UK. The group has the highest ABS score (2.75) of the communities and contains the "youngest" set of journals but the low mean centrality score (6.3) is consistent with their location toward the periphery of the network (top right-hand side of Figure 1).

Miscellaneous (M)

Seven journals form this quasi-community (HCI, IJTM, IJTMSD, JPA, MSQ, PIME and RESS). The group has a low ABS score (1.57), a low membership number per journal, low affiliation to business schools (31.4%), and low affiliation to USA-based organisations

(37.1%). The lowest mean centrality score of any group (2.3) indicates that the journals in this group are located at the edge of the network. As commented earlier the group include the two journals that are disconnected from the network (isolates) and the two "pendants" i.e. where a journal is connected to only one other journal.

Operations, performance and systems (OP&S)

Five journals comprise this community (IJASM, IJBPM, IJOPM, IJPPM and JMTM) and have the smallest-sized editorial advisory boards measured on members per journal (32.8). The mean ABS score for this group (1.6) is well below the average for the whole data set. Journals in the group display an average membership affiliation to business schools (48.8%) and have the lowest affiliation to USA-based institutions (13.4%) in the field. This could link to the journal publishers being wholly European with two Swiss and three UK publishers. The group has some journals with high centrality measures (mean of 15.0) showing the journals occupy a central position in the network.

Project and engineering management (P&EM)

The four journals in this community (IEEETEM, IJPM, JCEM and PMJ) are above average size on number of EAB members per journal (58.8 vs. 50.0) and above average on the ABS score (2.25 vs. 2.03). The longest-established journals can be found in this group and overall the group has one of the highest membership affiliations to USA institutions (60.8%). Three out of the four journals are linked to US societies. The community's low mean centrality score (5.8) reflects their position at the left-hand periphery of the network diagram (see Figure 1).

Quality and process (Q&P)

This community contains five journals (BMK, BPMJ, IJQRM, KPM and TQMBE) that are below average in size as measured by mean members per journal (36.8 vs. 50.0) and they have the lowest mean ABS score of the groups (1.40). The community has the highest non-university affiliation (20.2%), although the percentage of university affiliation is still high. The membership affiliation to USA-based institutions is one of the lowest of the communities (28.8%) with four out of five journals having UK-based publishers. The group's centrality score (12.6) is above average for the communities.

Supply and Logistics (S&L)

With eight journals, this is the largest community (IJLM, IJLRA, IJPDLM, JBL, JOM, JPSM, JSCM and SCM). Overall, the journals in this group also have the highest mean number of board members compared to other groups, thus accentuating their position in the OSCM field. The group's mean ABS score (2.25) is higher than the average (2.03) for the overall field. The group has the highest proportion of members affiliated to business schools (81.8%) and to USA-based institutions (61.1%); and has the highest female proportion of 17.4% (Table 5). Four of the journals have publishers based in the UK, two in the US and two on the European continent. The S&L community has one of the highest levels of connectedness within the network on the basis of degree and has the highest level of between-ness.

Network structure and communities

A typical way of analysing a network is to divide it into a core and a periphery, in our case this means aggregating communities into larger units. We identify C&P, OP&S and S&L as core communities based on having values for both degree and between-ness above the means for the overall set of communities (Table 5). This splits the set of 38 journals into 18 journals in the three core communities and 20 in the four communities on the periphery. The network core can be established in other ways, such as with a clique analysis. The term clique means that every journal in a group is connected to every other journal in the group. Using the journal interconnections, the network's central core comprises a clique of the six journals which have the highest number of connections (degrees) within the network (see Figure 4a). This central core links three journals from the C&P community, two from S&L and one from Q&P.

Figure 4 about here

So far the analysis has simply considered whether ties exist or not between journals. By taking account of the value of the ties, i.e. how many board members are shared by each pair of journals, then the reason for including JOM within the S&L community becomes clearer. Figure 4b shows the connections between those journals with a high strength of tie, i.e. a high number of overlapping board members between two journals. This figure shows only those journals that have more than 11 board members in common between themselves and a second journal. Of the six journals that appear in this figure, five of them are in the S&L group, the other is IJOPM (OP&S community). Figure 4b illustrates a reason for including JOM within the S&L group, namely its high overlapping board memberships with JBL and JSCM. The figure also shows that the same 42 individuals feature on the EABs of both JBL and

IJPDLM; constituting 26.9 percent of the 156 members of the EAB of the former and 46.7 percent of the 90 in the latter (Table 3). Why there should be this coincidence is not clear since the journals are linked with different publishers. Both journals cover logistics but so do two other journals (IJLM and IJLRA).

Figures 4a and 4b portray distinctly different views of the core journals in the field. Both views contain six journals but only one journal, JOM, is common to both. Figure 4b is constituted overwhelmingly by S&L journals while the major community featuring in Figure 4a is C&P. In Figure 4b, the S&L journal JBL occupies a central position which conveys an important brokerage role, although the journal is not highly scored by the ABS (i.e. 2). The mean ABS score for the journals in Figure 4a is 3.0 while for Figure 4b it is lower at 2.67. As JOM is the only ABS-scored 4* journal in the 38 journals that comprise the whole OSCM field, then its location in the S&L community has a beneficial outcome of lifting the mean score for this community. Such a marked difference between the two perspectives of the field contained in Figures 4a and 4b highlights that the S&L community differs from the more traditional communities by virtue of the higher number of academics that link their journals together.

Figure 5 shows a two-mode sociogram of board members connected to journals (blue squares) for those fifteen board members (red circles) who have four or more board memberships. Eight out of the ten board members shown in Table 9 also appear in Figure 5. Only 11 out of the 38 journals feature in this figure and these are the more connected journals by virtue of each possessing an EAB member who connects to three other journals. A cluster of six of the S&L group (IJLM, IJPDLM, JBL, JPSM, JSCM and SCM) lies at the top centre of the figure surrounded by ten individuals who are linked through EAB membership to at least four out of the six journals. Again this shows the connected nature of S&L journals. Of the two remaining S&L journals (i) IJLRA does not feature at all in the diagram while (ii) JOM is positioned toward the bottom right of the figure to connect with three individuals who also have board memberships with IEEETEM. At the bottom left are two individuals who link to SCM, IJCIM, JMTM and IJASM.

Figure 5 about here

Individual academics and their demographics

Tables 6 to 9 present various detailed aspects of the data including demographics. Table 6 focuses on geographical location while Table 7 gives the locations of the most frequently-

affiliated organisations. Table 8 shows the distribution of EAB memberships to individual academics. The vast majority of individuals (86.7%) only have one place on an editorial advisory board in the sampled journal set, while only ten out of the 1,533 individuals in the sample have five or more memberships. The ten individuals comprising this super-elite are listed in Table 9.

Table 6 about here

Table 7 about here

Table 8 about here

Table 9 about here

Gender

For the overall EAB data set 11.6% are female. If EAB members are seen as an elite drawn from all OSCM academics, then editors-in-chief are a super-elite. For the data set 6.1% are female. Those with multiple EAB memberships (as in Tables 8 and 9) can be considered another form of super-elite. It is interesting that three out of the ten academics with the hightest multiple EAB memberships, i.e. thirty per cent (Table 9), are female compared to only 11.6 per cent for the overall data set. However, an analysis of all EAB members shows that gender distribution does not significantly vary by number of memberships (Chi square test – see Table 8). Surprisingly Table 4 shows that the percentage of females positively correlates with journal age, i.e. females are more likely to feature in "older" journals.

Geographic location

Table 6 shows the dominant position of members drawn from USA-based organisations. The table also indicates how the organisations are dominated by those based in English-speaking countries of the world, e.g. the top four entries in the table fall in to this category. In total over two thirds of the memberships are held by individuals affiliated to organisations in countries that have English as the primary language. Table 7 reflects how affiliation to organisations located in the US dominates the list of top ten organisations based on number of EAB memberships. Eight out of ten organisations are located in the US which is nearly twice the proportion of individuals affiliated to US-based organisations in the overall sample. This discrepancy probably reflects a number of factors such as US-based organisations being larger in size than non-US-ones, US universities dominating the world quality rankings for universities and US universities being prominent in the OSCM field. Four out of the ten super-elite in Table 9 are affiliated to institutions in the US which matches with the 38.7% for

the overall data set. The statistical tests reported in Table 8 show that the number of editorships is positively and significantly correlated with the individual's affiliation to USA-based organisation.

Business school affiliation

The statistical tests reported in Table 8 show that the number of editorships is positively and significantly correlated with the individual's affiliation to a business school. Sixty one percent of editors-in-chief are located in business schools which is higher that the 49% % for the whole data set; but this is not statistically significant on a Chi square test.

Discussion

Finding 1: Applying SNA to journal EABs is a useful and novel method of gaining insight in to the OSCM field

The novel application of SNA to EABs has usefully identified communities within the OSCM field. The method's novelty and scope provides a way of looking at the field that adds to those of previous studies, e.g. the typical studies such as CCA work with a small set of journals and focus on knowledge content. This study's method covers a broad set of journals and specifically uses social connections to mark out communities within the whole of the OSCM field. This focus on the social is a major difference between this method and others which have focused on knowledge content.

However, not all the journal allocations to communities are as strong as others. For example, the M&S community appears more like the amalgamation of two small sub-groups – one contains the business school- and USA-affiliated journals MSOM and POM, and the other contains JFMS and JOS that are affiliated to non-business school and non-USA-based institutions. The allocation to communities made in this study may not align with where journal editorial teams see their journal is positioned. However, we believe our account of the approach serves to explain why we have arrived at our conclusions.

On the whole the communities determined in this study cut across the knowledge groups identified in those previous studies listed in Table 1. For example, the consensus of these previous studies is that the largest knowledge group is manufacturing strategy - but no one journal has a title and/ or purpose that reflects an explicit, sole focus on this one topic. A

good proportion of the journals cater for articles addressing many of the knowledge groups, thus taking a generalist stance, while other journals can be recognised as more specialist in nature, e.g. those in the Q&P group. Pannirselvam et al. (1999) in their analysis identified specific journals that addressed many of their 17 knowledge categories (IJOPM – 17, IJPR – 15, JOM – 14, etc.)

Finding 2: The network has a generalist core of journals and a specialist periphery

Such generalist journals described above tend to be positioned at the centre of the network within the central communities. At the core of the OM field's map in Figure 3 lie two adjacent but separated communities (C&P and OP&S) that, although different in mean ABS scores, collectively form what could be identified as the traditional core of the OSCM field. The third community that forms the core is S&L. Notwithstanding the difference between the journal-directed nature of this study and the article-directed nature of many of the previous studies, connections can be seen between the communities and the knowledge groups, particularly in the more "specialist" of the identified communities. For example, service, quality, performance measurement and supply chain are labels common to both knowledge groups and communities.

Finding 3: SCM is a strong, central component of the field

Apart from the S&L community forming part of the central core in Figure 3, other aspects of the results reinforce its importance. As indicated earlier, Figures 4a and 4b each contain six journals but portray distinctly different views of the centre of the field's core, with JOM as the only journal common to both views. Although in the MDS (Figure 3) JOM lies close to other high-ranking journals such as IJOPM, IJPR and IJPE that form part of the traditional core (as in Figure 4a), our analysis places JOM within the S&L group because of the multiple interlocks between JOM and S&L journals (Figure 4b). This inclusion of the field's strongest journal, in terms of ABS scores, in the S&L group emphases the group's importance. While Figure 4a considers the number of connections (i.e. interlocks) between journals irrespective of the number of members shared between the journal pairs, Figure 4b takes account of the number of academics involved in the connection (i.e. multiple interlocks). The analysis shows that S&L is a formidable group when we consider particularly the number of over-lapping EAB members within a journal interlock. Leaving aside IJOPM, journals from outside of the S&L community do not have this extent of overlapping membership. Figure 5 reinforces this view of S&L as a significant group. The strength and coherence of the S&L

community raises a number of questions. These include: why do S&L journals cohere so strongly, and is this coherence the result of a deliberate strategy on the part of those charged with journal governance or an emergent feature?

SCM as a topic has increased so dramatically that it now comes out as either the top (Taylor and Taylor, 2009; Walker et al., 2015) or one of the top (Behara et al., 2014) knowledge categories in studies of the content of OSCM journal papers. Could it be that this SCM expansion in recent times has created excess demand for EAB members compared to other communities? An expansion of the area accompanied by the setting up of new journals could create new demand. Although the mean age for the S&L community journals lies at approximately the mean age for all communities in the OM field (28.2 years vs. 27.2); the community does contain a number of more recently-established journals. Recent expansion of board sizes of the S&L journals could have created excess pressure for more board members. The S&L community has the largest mean board size (83.6) compared to other communities (the overall mean is 50); a feature that is influenced by the community including two journals (JOM and JBL) with large boards (177 and 156 respectively).

However, increased demand per se does not lead to the higher level of interlocks; it needs to be coupled with scarcity of supply that leads to increased use of individuals who already have board memberships with other journals. If there were scarcity of supply then one might expect that the USA affiliation would be tempered by bringing in academics from outside this milieu – this does not seem to be the case. The S&L community has the highest proportion of members drawn from US-affiliated organisations and from business schools. Interestingly despite the SCM paradigm emphasising globalisation the S&L community has strong affinities to one part of the globe, i.e. the US.

Clearly the mechanism by which this strongly-connected SCM-related group appears to challenge the traditional core is not apparent but is open to speculation. One could argue that what we are seeing is a specific group, primarily drawn from US business schools, promoting the interests of a particular intellectual endeavour (SCM) that is (reasonably) novel, popular and challenges the more established order within OSCM. No doubt a mixture of deliberate and unconscious actions by the involved proponents fuel the apparently increasing ascendancy of SCM in the intellectual structure. For example, journal editors looking to strengthen their journal in an expanding area of knowledge invite EAB members from journals working in a similar intellectual area. As indicated earlier this agrees with the concept of homophily drawn from Social Network Theory where social actors prefer to link up with other actors that are similar to themselves.

What may be happening in the OSCM field is a paradigmatic shift with SCM supplanting the prior institutionally-focused traditional OM view. If this is so then it will be occurring at both intellectual and social levels, and could be revealed through a longitudinal analysis. A Kuhnian view (Kuhn, 1996) is that paradigm shifts are neither good nor bad – they just are. Commentators within management have written about paradigm change, e.g. Pfeffer (1993) has argued for a strong, single paradigm while others have argued for a plurality of theoretical approaches (Van de Ven, 1989) (Fabian, 2000). OSCM commentators have discussed changes in topics, theories and paradigms e.g. (Walker et al., 2014; Walker et al., 2015). Such changes will influence the composition of EABs, as indicated above in the discussion of the impact of the growth in SCM.

Presumably someone in the OSCM field, lying outside of the SCM area, might feel threatened by such a paradigm change. Some academics might see SCM as an emerging component of OM. However, this perspective is not uncontested. If we examine writing within the SCM journals then we see that those authors affiliated to the supply chain area can, and do, take a different position. Frankel et al. (2008) and Mentzer et al. (2008) work from the basis that SCM lies outside of OM, and other functions, and serves to integrate these other functions. Mentzer et al. specifically write about the "turf wars" over who owns, or doesn't own, SCM. However, given the formidability of the SCM grouping we may need to ask in future whether SCM owns OM.

Finding 4: Demographic diversity is an issue for the field

Gender

For AACSB business schools female representation in all academic staff is 29.9% while the value for full professors alone is 19% (Flynn et al., 2015). The AACSB gives the female proportion for the Production/ Operations field as 19.3% for all ranks and 12.3% for full professors. Comprising 3.6% of all business school academic staff (AACSB, 2013), this field is the smallest of the main fields listed by the AACSB and is also the main field with the worst gender imbalance. The female proportion of 11.6% for the study data set is significantly lower (Chi = 46.2, p = .000, df = 1) than the AACSB figure of 19.3 % for the overall field suggesting that gender discrimination exists in the appointment of EABs. In the high status position of editor-in-chief, the female proportion at 6.1% is even lower than the 11.6% of the overall EAB data set.

If one were to argue that EAB membership is associated with seniority and the

proportions of females were improving at lower levels of the profession, then the above difference in proportions between status levels might reflect poorer gender representation in the past. However EAB memberships are not restricted to the rank of full professor, and are often seen more as an award of merit achieved irrespective of rank. The correlation between gender and rank is also evident in the AACSB data where female proportion declines with rank. This correlation is usually interpreted as evidence of discrimination rather than dynamic changes in female proportions. Even if the correlation was evidence of such dynamics, the actual female proportions are still worrying low.

The AACSB data is a relevant comparator given the dominance of affiliations to US organisations in the study data set. However, affiliation to US organisations does not, of itself, mean that the individuals sampled have US nationality since US organisations attract individuals to work in them from across the globe. Notwithstanding this point, the study provides evidence of gender imbalance. Overall the results point to poor gender diversity specifically in journal governance and more generally in the OSCM field. We believe OSCM academics should be concerned about this.

In Table 4 the male percentage is negatively correlated with Business School affiliation. This suggests that OSCM academics located in non-Business faculties, such as Engineering, are more likely to have an even higher proportion of males. This points to one of the beneficial aspects of the growth in the SCM area, namely that out of all the communities, S&L has the highest business school and female involvement.

Geographic location

The domination of the OSCM field by academics affiliated to US institutions seems to reflect the situation in management and business generally (Burgess and Shaw, 2010). This reflects the US position in higher education generally. However, a broader source of domination extends outside of the US to UK and other English-speaking countries. Further to this, the importance of European countries can be seen in Table 6 which also shows that there could well be connections to the location of the society/ publisher responsible for the journal. A comparison of the two traditional core elements (C&P and OP&S) with the more recent element of S&L shows that S&L is more associated with US-based academics than the other traditional two.

A further issue is that only one individual out of the top ten with multiple EAB memberships (Table 9) comes from the top ten institutions with the highest numbers of EABs (Table 7). This suggests that if multiple EAB memberships is taken as evidence of individual

achievement then high-performing individuals do not need to be, and are not, located in the highest-performing organisations as measured by volume of involvement in EABs. This suggests that geographic location is more important than status of the individual's institution in securing EAB membership.

Business school affiliation

Just as the OSCM communities form their wider field, the OSCM field is part of a wider grouping of management and business fields that are particularly influenced by the business school context. Business schools are the dominant locations for business and management subjects across the globe and their size and influence within universities has grown over recent decades. As mentioned earlier, the traditional OM subject grew out of Production and Factory Management and many OM-related academics are still located within such as engineering faculties today with 51% of EAB members located outside of business schools. The traditional elements of the field's core, C&P and OP&S, have 27.3% and 48.8% respectively of EAB members drawn from business schools while S&L has 81.8%. This indicates that the phenomenon of SCM is strongly-rooted in business schools.

Conclusion

This final section comments on the study contribution, implications, limitations and opportunities for further study. The study's aim was to contribute to better understanding of how the OSCM academic field is comprised of various communities by addressing the research question: how do the interlocking EABs of OSCM journals map out the field's diverse academic communities and how demographically diverse is the field and its communities?

Contribution

The study is novel by virtue of applying SNA to EAB data, and in its application to a unified field of operations and supply chain management (OSCM). No prior studies of this type have been carried out for either of the two areas of OM or SCM. The study has identified journal groupings that mark out linked, but separable, academic communities within OSCM. Deducing communities from social connections for web-based EAB data may elicit scrutiny because of its novelty; however we have shown it to be a suitable technique to add to other approaches to mapping a field's intellectual structure. By collecting data from the web we

were able to cross-check data speedily thus enabling the study to draw from a quality data set which runs counter to the view that web sources can be of suspect value.

Our study maps out a network with a generalist core and a more specialised periphery. We identify what appears to be a particularly influential and burgeoning community of SCM academics that, together with two other communities representing traditional OM interests, form the core of the field. We highlight how the SCM community differs from other communities comprising the OSCM field, in particular by its high coherence, more favourable gender balance and its high affiliation to business schools.

The study demonstrates the dominance of males in EABs and the influence of affiliation to USA-located institutions and to business schools. The study shows that the gender imbalance in EABs is poorer than that in the general population of OSCM academics, thus providing prima facie evidence of discrimination.

Implications

By applying SNA to EABs we have added a new method of taking stock of the field to the researcher's armoury – one that uses a social rather than a knowledge focus. With the increase in research reflexivity, such methods and related study outputs will increase in value for researchers. This study has provided a benchmark for the OSCM field that can be compared with future studies and have thus enabled a longitudinal study of the field's social dynamics. At a more down-to-earth level the study's allocation of journals to communities can be used by researchers to help target where to submit their papers. For example, if a paper is not accepted by a particular journal then the researcher can look to the other journals in the community as suitable targets.

The study provides evidence of the lack of diversity within the OSCM field by showing how low female representation and US domination is embedded within the field's journal governance structures. While the influence of S&L appears to bring with it an improved female representation compared to other parts of the OSCM field, this representation is still at a low level, and conversely comes at the cost of increased influence of US business schools. The analysis throws up a challenge for the field to grapple with – how can OSCM create a more equitable and representative position in the field's journal governance and in the field itself?

The existing publishers of OSCM journals who are located in the US, UK and other European countries will no doubt know already of the powerful stake they have in the field.

However publishers from those countries not already represented could well be attracted to compete in the field. Leaving such a possibility aside. current publishers might wish to consider what influence they might bring to bear to expand representation. Clearly looking to appoint female editor-in-chiefs could have a positive impact on EAB gender balance (Mauleón et al., 2013) and looking for candidates from outside of the US and UK could well be useful. However editor-in-chiefs and other members of the editorial team might also review their rules and routines for their journal governance. For example they could take action by introducing, if they do not do so already, audits of their EAB demographics, EAB appointment criterion that are transparent and fit for purpose, and gender-blind appointments. Of course there is a limit to what they can do if the membership of the OSCM field continues to be demographically imbalanced. Presumably this is where business school deans and appointment committees have a role to play in trying to encourage a more demographically-balanced workforce. However, the popularity of OSCM and its attractiveness to potential entrants to the academic profession is a constraining factor. In the past OSCM has gone through periods when its perceived value has been lower than at present – which is not that particularly high; but the advent of such as lean thinking has helped to renew interest within academia and business. The upsurge in SCM highlighted here has also increased the interest of potential entrants in a key contributor to today's global economy. The issue of popularity and attractiveness of OSCM raises questions about its standing versus other disciplines and fields within business schools. OSCM, as pointed out earlier, has the smallest proportion of staff of all the main fields in business schools and has the worst gender imbalance. Presumably these two factors are linked?

Finally in terms of implications we comment as follows. Given the study findings on gender imbalance, geographic location and business school location we suggest OSCM academics might reflect on their professional circumstances. Consider how a female university academic based outside of the dominant group English-speaking countries who does not specialise in SCM, e.g. they specialise in quality, might feel after reading the results of this study.

Limitations

The set of OSCM journals used in the study is a comprehensive one, but does not include every journal that is OM- or SCM-related. Since the study was completed a more extensive list has been published in the updated version of the ABS journal quality rankings. Using the well-regarded ABS list does mean that all the key OSCM journals are included in our study,

however it does have the drawback that the ABS scores may be criticised as favouring European-related journals. The study focuses on those journals classed as OM and SCM. It does not include journals in associated and reference disciplines where OM academics also publish, e.g. Management Science and other OR/MS journals; nor does it cover general management journals where they could publish. A wider study could be carried out that included these other journal types, but this would be a more substantial, future endeavour that would cast light on the connections that the OSCM communities made to communities in adjacent areas. This study focuses on journals and thus excludes books and other artefacts such as conference proceedings. However, this focus reflects that journal articles are the main knowledge products examined when evaluating management and business fields. While we may be unsure about why appointments are made to EABs and debate what the journal interconnections signify, their existence is undeniably a substantive social phenomenon that tells us something about the OSCM academic community.

Further study

Given that this study verifies a novel approach by applying it to the OSCM area, its use leads to the potential to deploy it in further studies. For example, a study could be carried out to compare the network structure and demographics of OSCM against similar fields. Whereas this study focuses on communities within OSCM, extending the analysis of EABs to reference and adjacent disciplines would give an informative picture of how OSCM is embedded within the wider academic terrain. A follow-up longitudinal study would illuminate any changes in the communities over time, e.g. the extent to which the S&L community might grow even more influential in future. This research studies at an aggregate level the results of EAB appointments; this leaves open opportunities to study the detail of why EAB appointments are made.

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Table 1 Example studies relating to the structure and evolution of the OM field

Author (date)	*Approach/ method*	*Main points*
Buffa (1980)	Conceptual	Identified key topics emerging over time, e.g. OM emerges distinct from MS/OR
Chase (1980)	Survey of articles grouped by authors (1977-79)	Applied 2x2 matrix of Research emphasis vs. Research orientation
Miller et al. (1981)	Delphi process with six stage categorisation and review	Four main topic areas
Mabert, (1982)	Article review and categorisation of topics	Categorised research or application focus by particular problem decision area
Voss (1984)	A two-day workshop attended by 50 + P/OM researchers	Field categorised into 10 areas
Amoako-Gyampah and Meredith, (1989)	Survey of topics in six OM research journals (1982-1987)	Categorised field into knowledge areas. Main area - operations control.
Meredith and Amoako-Gyampah, (1990)	Survey of topics of interest for 151 US OM academics	Categorised field into knowledge area
Neely (1993)	IJOPM articles categorised by 2 x 2 framework.	Micro/ macro research focus x research emphasis (hard/ soft)
Vokurka (1996)	Citation analysis to assess most cited of four key journals	Top 10 most cited journals identified
Scudder and Hill (1998)	Survey and classification of 477 OM papers by author perception of OM focus	Papers classified by knowledge categories and research methods
Pannirselvan et al., (1999)	Content analysis of articles in 7 journals 1992-97 by 17 types	Strategy and quality more prominent. Topics emerging include NPD and SCM
Pilkington and Liston-Heyes (1999)	Citation and co-citation study of IJOPM 1994-97	Topics include manuf. strategy, Japan, perf. measurement and best practice
Barman et al. (2001)	Survey of how POMS academics rank 21 journals	Little change in field since previous study (Barman et al., 1991)

Vastag and Montabon (2002)	Analysis of rating & referencing practices for 28 journals	Three categories of journals: OM, OR and Management and four "outliers"
Chopra et al. (2004)	Historical analysis	OM focus on tactical issues changing over time to strategic, SCM increasing
Pilkington and Fitzgerald (2006)	Citation & co-citation analyses of IJOPM 1994-2003	Manuf. Strategy incl. RBV, Perf. Measurement, Lean, SCM, etc.
Sprague (2007)	Historical narrative	Editorial for special issue on evolution of the field of operations management
Craighead and Meredith (2008)	Content analysis of MS, DS, POM, JOM, IJOPM 1995-2003	OM becoming more interpretive. Jnls emerging to cover service & SCM
Pilkington and Meredith (2009)	Citation analysis of articles in JOM, IJOPM & POM 1980-2006	Key knowledge groups: manuf. strat. , quality, process design, etc. But strat. & tactical topics losing out to SC & quality
Kulkarni et al. (2011)	Latent Semantic Analysis of 30 years of IJOPM articles	Identified major topics and methods
Petersen et al. (2011)	Meta-analysis of journal ranking & citation analysis of IJOPM, JOM & POM 1999-2005	OR and OM separating, SCM more prominent
Singhal and Singhal (2012)	Historical view of various paradigm shifts occurring in OM	SCM as latest paradigm to emerge
Simpson et al. (2015)	Thoughts of a large group of scholars in the field of operations and supply chain management (O/SCM) regarding current and future issues facing profession	Need for: greater innovation and creativity in O/SCM research, handling complexity and "big data," collaborating and working in other research domains, confronting new technology, and communicating value of research
Shiau et al. (2015)	Co-citation study of papers in Web of science containing "supply chain management"	Identified four core research areas: sustainability, strategic competition, value of information, and development of SCM
Walker et al. (2015)	Content analysis of papers in JOM, POM and IJOPM 1980-2013 to identify theories and topics	Claims while previous research looks at topics this is the first paper to look at theoretical trends in OM

Table 2 List of journals included in the study

Code	*Journal Name*	*Society/ Publisher*	*Country*
BMK	Benchmarking	Emerald	UK
BPMJ	Business Process Management Journal	Emerald	UK
CIE	Computers and Industrial Engineering	Elsevier	Netherlands
HCI	Human-Computer Interaction	Taylor & Francis	UK
IEEETEM	IEEE Transactions on Engineering Management	IEEE	US
IJASM	International Journal of Agile Systems and Management	Inderscience	Switzerland
IJBPM	International Journal of Business Performance Management	Inderscience	Switzerland
IJCIM	International Journal of Computer Integrated Manufacturing	Taylor & Francis	UK
IJLM	International Journal of Logistics Management	Emerald	UK
IJLRA	International Journal of Logistics: Research and Applications	Taylor & Francis	UK
IJOPM	International Journal of Operations and Production Management	Emerald	UK
IJPDLM	International Journal of Physical Distribution and Logistics Management	Emerald	UK
IJPE	International Journal of Production Economics	Elsevier	Netherlands
IJPM	International Journal of Project Management	Taylor & Francis	UK
IJPPM	International Journal of Productivity and Performance Management	Emerald	UK
IJPR	International Journal of Production Research	Elsevier	Netherlands
IJQRM	International Journal of Quality and Reliability Management	Emerald	UK
IJTM	International Journal of Technology Management	Inderscience	Switzerland
IJTMSD	International Journal of Technology Management and Sustainable Development	Intellect	UK
JBL	Journal of Business Logistics	Council of SCMP/ Wiley	US
JCEM	Journal of Construction Engineering and Management	ASCE	US
JFMS	Journal of Flexible Services and Manufacturing	Springer Verlag	Germany
JMTM	Journal of Manufacturing Technology Management	Emerald	UK
JOM	Journal of Operations Management	Elsevier	UK
JOS	Journal of Scheduling	Springer Verlag	Germany
JPA	Journal of Productivity Analysis	Elsevier	Netherlands
JPSM	Journal of Purchasing and Supply Management	Springer Verlag	Germany
JSCM	Journal of Supply Chain Management	Wiley	US
KPM	Knowledge and Process Management	Wiley	US
MSOM	Manufacturing and Service Operations Management	Emerald	UK
MSQ	Managing Service Quality	INFORMS	US
PIME	Proceedings of Institute of Mechanical Engineers Part B: Journal of Engineering Manufacture	IMechE/ Sage	UK/US
PMJ	Project Management Journal	POMS/ Wiley	US
POM	Production and Operations Management	Taylor & Francis	UK
PPC	Production Planning and Control	PMI/ Wiley	US
RESS	Reliability Engineering and System Safety	Elsevier	Netherlands
SCM	Supply Chain Management	Emerald	UK
TQMBE	Total Quality Management and Business Excellence	Taylor & Francis	UK

Table 3 Characteristics for individual journals and their EABs grouped by communities

Jnl code	*Group*	*Society/ Publisher*	*Country*	*Size of board*	*Degree*	*Betweenness*	*% Male*	*% Bus Schl*	*% Univ*	*% USA*	*ABS score*	*Age (yrs)*
CIE	C&P	EL	Neth	55	10	14.2	96.4	12.7	94.5	47.3	2	39
IJCIM	C&P	T&F	UK	48	13	5.2	91.7	10.4	89.6	25.0	2	28
IJPE	C&P	EL	Neth	57	17	25.4	98.0	45.3	96.5	31.6	3	26
IJPR	C&P	EL	Neth	41	19	31.6	87.8	41.5	100.0	29.3	3	54
PPC	C&P	W	US	56	18	31.7	94.6	28.6	94.6	25.0	3	25
HCI	M	T&F	UK	23	0	0	87.0	4.3	69.6	78.3	1	29
IJTM	M	IND	Switz	23	0	0	100.0	13.0	34.8	30.4	2	29
IJTMSD	M	INT	UK	25	1	0	84.0	20.8	92.0	12.0	1	13
JPA	M	EL	Neth	54	1	0	88.7	59.3	94.4	46.3	2	26
MSQ	M	INF	US	36	4	0	69.4	83.3	100.0	36.1	1	24
PIME	M	IMechE	UK	29	8	1.9	93.1	3.4	100.0	13.8	1	33
RESS	M	EL	Neth	47	2	0.5	93.6	4.3	74.5	38.3	3	29
JFMS	M&S	SV	Germ	37	3	2.3	83.8	24.3	100.0	2.7	2	31
JOS	M&S	SV	Germ	40	6	11.8	97.5	20.0	97.5	25.0	3	18
MSOM	M&S	EM	UK	59	3	0.9	84.7	91.5	100.0	84.7	3	17
POM	M&S	T&F	UK	20	8	10.3	85.0	95.0	100.0	95.0	3	24
IJASM	OP&S	IND	Switz	31	15	9.3	96.7	16.1	96.8	9.7	1	9
IJBPM	OP&S	IND	Switz	42	17	36.1	92.9	40.5	88.1	7.1	1	17
IJOPM	OP&S	EM	UK	40	14	6.0	82.5	80.0	100.0	20.0	3	35
IJPPM	OP&S	EM	UK	21	13	7.2	71.4	52.4	85.7	14.3	1	64
JMTM	OP&S	EM	UK	30	16	7.5	85.7	50.0	100.0	16.7	2	26
IEEETEM	P&EM	IEEE	US	116	9	29.0	78.4	78.9	99.1	69.8	3	61
IJPM	P&EM	T&F	UK	34	5	5.5	91.2	55.9	97.1	17.6	2	33
JCEM	P&EM	ASCE	US	42	3	0	88.1	2.4	100.0	73.8	2	32
PMJ	P&EM	POMS	US	43	6	11.2	90.7	41.5	69.0	58.1	2	46
BMK	Q&P	EM	UK	26	12	2.6	96.2	76.9	88.5	57.7	1	21
BPMJ	Q&P	EM	UK	55	13	5.4	96.4	54.5	92.7	27.3	1	20
IJQRM	Q&P	EM	UK	28	17	14.7	100.0	59.3	92.9	21.4	2	32
KPM	Q&P	W	US	45	7	0.5	82.2	35.6	50.0	28.9	1	22
TQMBE	Q&P	T&F	UK	30	14	18.0	96.7	32.1	80.0	13.3	2	25
IJLM	S&L	EM	UK	52	10	4.7	88.5	86.5	98.1	59.6	2	25
IJLRA	S&L	T&F	UK	39	8	4.1	87.2	55.3	89.7	10.3	2	18
IJPDLM	S&L	EM	UK	90	15	17.9	76.4	85.2	100.0	46.7	2	45
JBL	S&L	W	US	156	15	81.3	85.3	88.5	96.2	88.5	2	36
JOM	S&L	EL	Neth	177	23	50.8	82.8	78.5	99.4	68.9	4	35
JPSM	S&L	SV	Germ	65	15	63.6	86.2	81.3	100.0	26.2	2	21
JSCM	S&L	W	US	52	11	6.6	78.8	92.3	100.0	80.8	1	51
SCM	S&L	EM	UK	38	19	21.4	89.5	68.4	92.1	34.2	3	19
Mean				50.1	10.3	14.2	88.4	49.2	90.9	38.7	2.0	29.9

Age in years at December 2015 since the journal was first published

Table 4 Pearson correlation between main journal-related variables

	Size	*Deg-ree*	*Bet-ween-ness*	*Percent Male*	*Percent Bus Schl*	*Percent Univ*	*Percent USA*	*ABS*	*Age*
Size	1	.368*	.706**	-.241	.397*	.245	.436**	.424**	.268
		.023	.000	.145	.014	.138	.006	.008	.104
Degree	.368*	1	.620**	.078	.318	.358*	-.150	.263	.123
	.023		.000	.641	.052	.027	.369	.110	.461
Betweenness	.706**	.620**	1	-.023	.335*	.246	.166	.331*	.146
	.000	.000		.890	.040	.137	.318	.042	.383
Percent Male	-.241	.078	-.023	1	-.489**	-.240	-.242	.091	-.432**
	.145	.641	.890		.002	.146	.144	.588	.007
Percent Bus Schl	.397*	.318	.335*	-.489**	1	.399*	.428**	.199	.160
	.014	.052	.040	.002		.013	.007	.232	.337
Percent Univ	.245	.358*	.246	-.240	.399*	1	.078	.227	.053
	.138	.027	.137	.146	.013		.641	.171	.751
Percent USA	.436**	-.150	.166	-.242	.428**	.078	1	.236	.246
	.006	.369	.318	.144	.007	.641		.154	.136
ABS	.424**	.263	.331*	.091	.199	.227	.236	1	.121
	.008	.110	.042	.588	.232	.171	.154		.469
Age	.268	.123	.146	-.432**	.160	.053	.246	.121	1
	.104	.461	.383	.007	.337	.751	.136	.469	

Note:

The first value in each cell is the Pearson correlation coefficient, while the second value is the significance level.

* conveys significant at the 5% level

** conveys significant at the 1% level

Table 5 Characteristics of journal editorial advisory boards for communities

Comm-unity	*Core/ periphery*	*Number of journals in comm-unity*	*Mean number in editorial advisory boards*	*Mean deg-ree*	*Mean bet-ween -ness*	*Per-cent male*	*Per-cent affil-iated to Bus Schl*	*Per-cent affil-iated to Univ*	*Per-cent affil-iated to USA*	*Mean ABS score*	*Mean age (yrs)*
C&P	C	5	51.4	15.4	21.6	94.0	27.3	94.9	31.9	2.60	34.4
OP&S	C	5	32.8	15.0	13.2	87.0	48.8	94.5	13.4	1.60	30.2
S&L	C	8	83.6	14.5	31. 3	83.6	81.8	97.8	61.1	2.25	31.2
M	P	7	33.9	2.3	0.3	87.7	31.4	83.5	37.1	1.57	26.0
M&S	P	4	39.0	5.0	6.3	87.8	57.7	99.4	51.3	2.75	22.5
P&EM	P	4	58.8	5.8	11.4	84.3	55.0	93.6	60.8	2.25	43.0
Q&P	P	5	36.8	12.6	8.2	93.5	50.3	79.8	28.8	1.40	24.0
Mean		5.4	50.0	10.3	13.2	88.4	49.2	90.9	38.7	2.03	30.2
p value ANOVA F test			.036 **	.000 ***	.029 **	.186	.009 **	.136	.094	.030 **	.213

* conveys significant at the .05 level
** significant at the .01 level
*** significant at the .001 level

Table 6 Top countries by EAB membership and location of journal society/ publisher

Country	*Top countries by EAB memberships*			*Top countries by journal's country of society/ publisher*		
	Number of memberships	*Percentage of total*	*Rank*	*Number of journals*	*Percentage of total*	*Rank*
USA	877	46.1	1	8	21.1	2
UK	263	13.8	2	18	47.4	1
Canada	70	3.7	3			
Australia	66	3.5	4			
China	65	3.4	5			
Germany	44	2.3	6	3	7.9	4=
Netherlands	42	2.2	7	6	15.8	3
Sweden	39	2.0	8			
Singapore	35	1.8	9			
Italy	35	1.8	10			
Switzerland	20	1.1	14=	3	7.9	4=

Table 7 Top 10 membership affiliations by organisation

Organisation	*Country*	*Number of memberships*	*Percentage of total*	*Rank*
Arizona State University	USA	35	1.84	1
Michigan State University	USA	33	1.74	2
Ohio State University	USA	32	1.69	3
National University of Singapore	Singapore	26	1.37	4
Pennsylvania State University	USA	21	1.11	5
University of Tennessee at Knoxville	USA	19	1.00	6
University of Manchester	UK	17	0.90	7=
University of Texas	USA	17	0.90	7=
University of California	USA	17	0.90	7=
Georgia Institute of Technology	USA	17	0.90	7=

Table 8 Distribution of editorial advisory board memberships to individuals and associated characteristics

Number of member-ships	*Number of individuals*	*Percentage of individuals*	*Percentage male*	*Percentage affiliated to USA*	*Percentage affiliated to Bus Schl*	*Number of member-ships*	*Percentage of member-ships*
1	1280	83.5	87.2	43.4	47.6	1280	67.3
2	182	11.87	87.8	48.4	72.5	364	19.14
3	46	3.00	91.3	56.5	76.1	138	7.25
4	15	0.98	87.5	80.0	86.7	60	3.15
5	6	0.39	50.0	50.0	66.7	30	1.58
6	2	0.13	100	0	50.0	12	0.63
7	0	0	-	-	-	0	0
8	0	0	-	-	-	0	0
9	2	0.13	100	50.0	100	18	0.95
Total	1533	100				1902	100
Sample size - n			1516	1533	1533		
Significance of Chi square test			0.49	0.017*	0.000***		

Chi square test of association with categories for memberships above 5 combined to avoid sparse matrix

* conveys significant at the 0.05 level

** conveys significant at the 0.01 level

*** conveys significant at the 0.001 level

Table 9 Top ten editorial advisory board members on number of memberships

Name	*Institution*	*Country*	*Gender*	*Number of memberships*	*Rank*
Gunasekaran, Angappa	Massachusetts Dartmouth University	USA	M	9	1=
Sohal, Amrik	Monash University	Australia	M	9	1=
Chan, Felix T.S.	Hong Kong Polytechnic University	China	M	6	3=
Christopher, Martin	Cranfield University	UK	M	6	3=
Bititci, Umit Sezer	Strathclyde University	UK	M	5	5=
Cheng, T.C. Edwin	Hong Kong Polytechnic University	China	M	5	5=
Cousins, Paul D.	Manchester University	UK	M	5	5=
Daugherty, Patricia J.	Oklahoma University	USA	F	5	5=
Ellram, Lisa M.	Miami University of Ohio	USA	F	5	5=
Hartley, Janet	Bowling Green State University	USA	F	5	5=

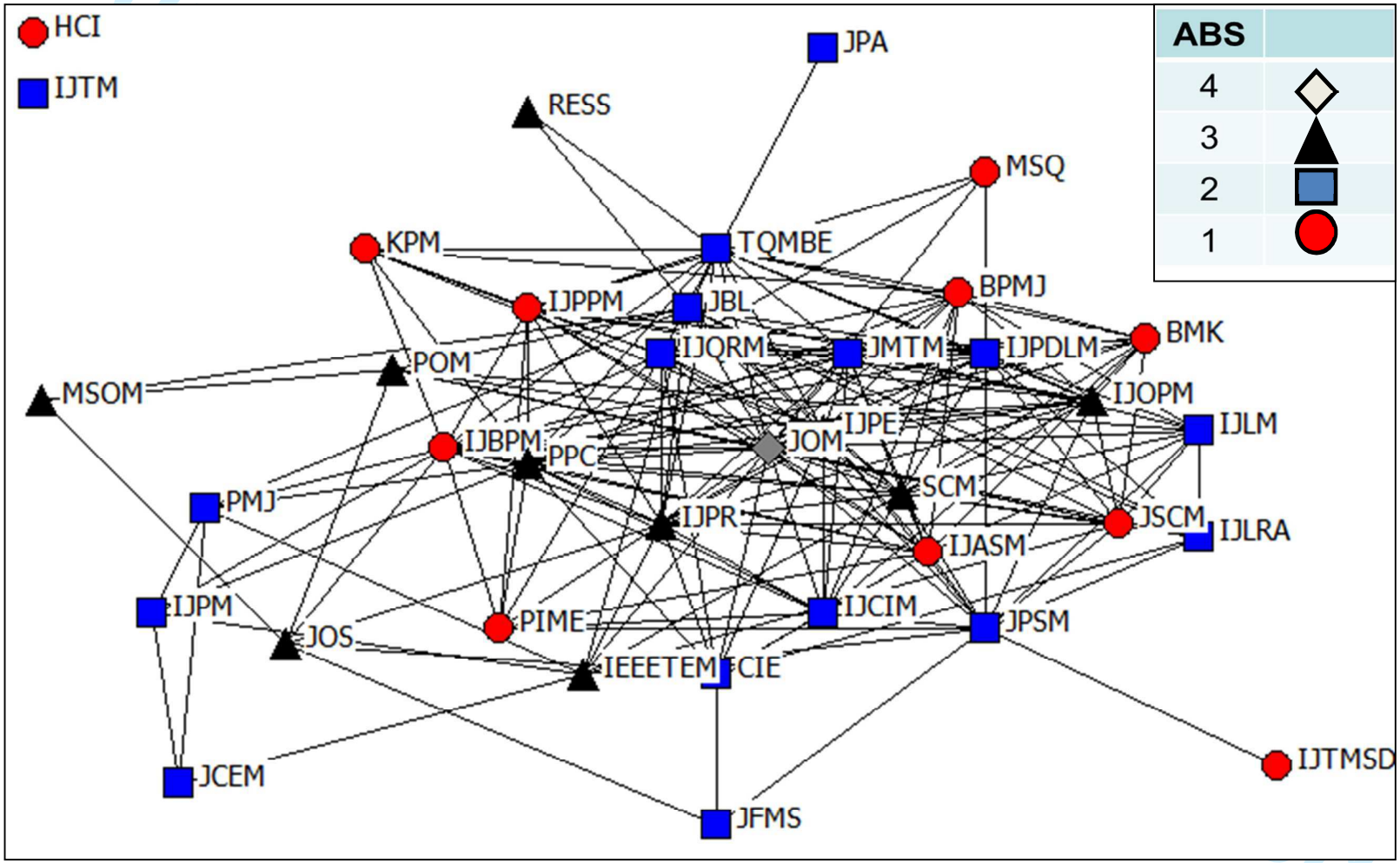

Figure 1 Journal network

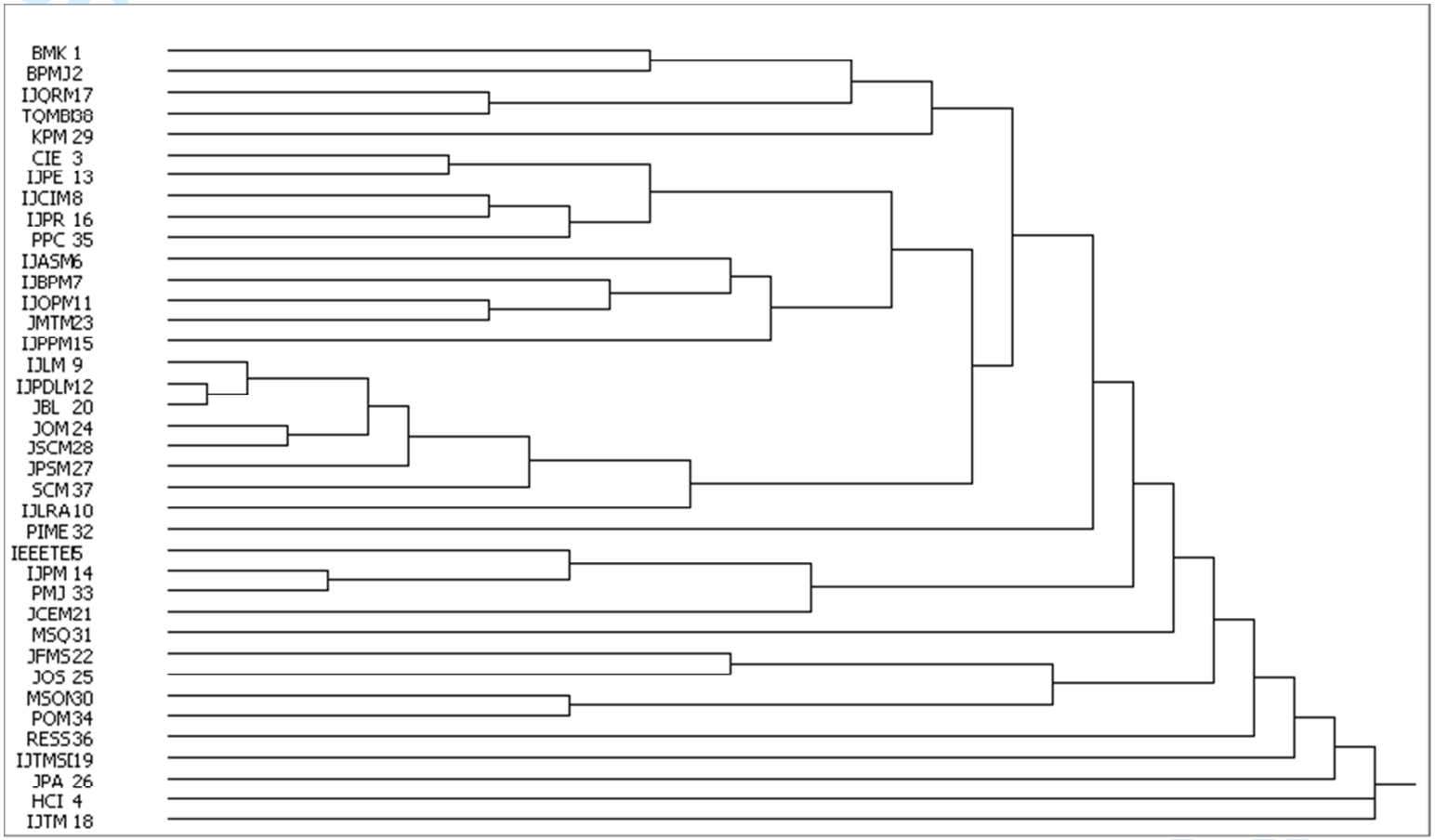

Figure 2: Hierarchical Cluster Analysis

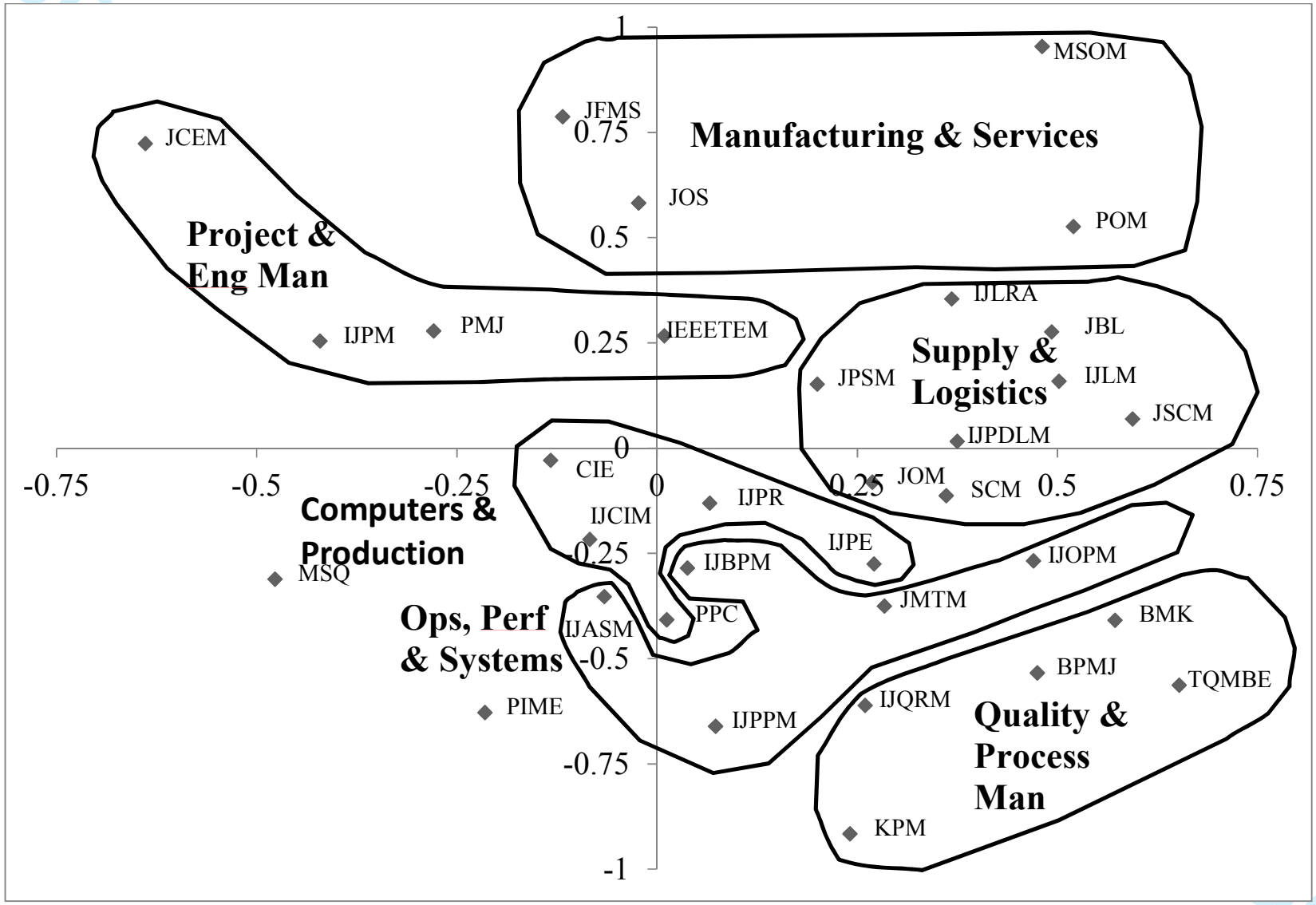

Figure 3 Multi-dimensional scaling plot of journals showing community groups

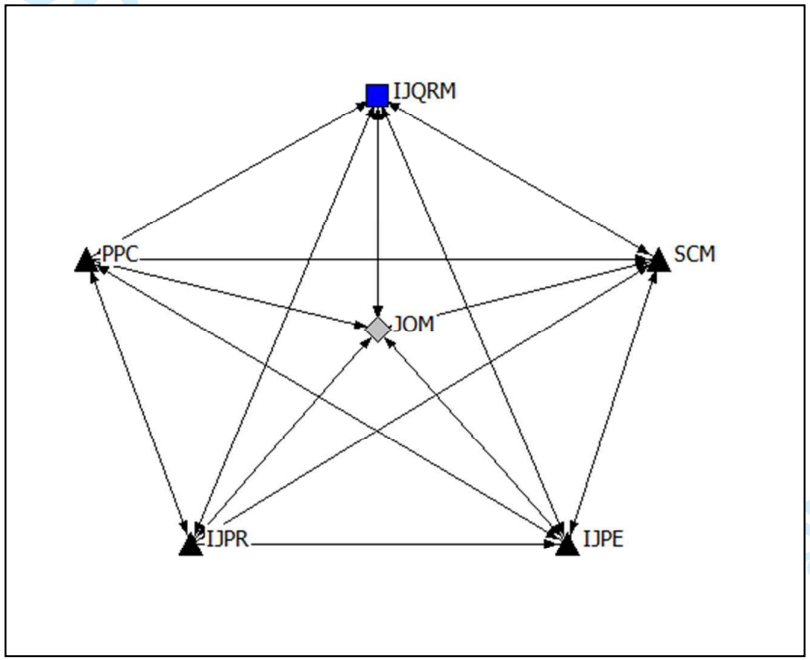

Figure 4 (a) Clique of six journals at the core of the network

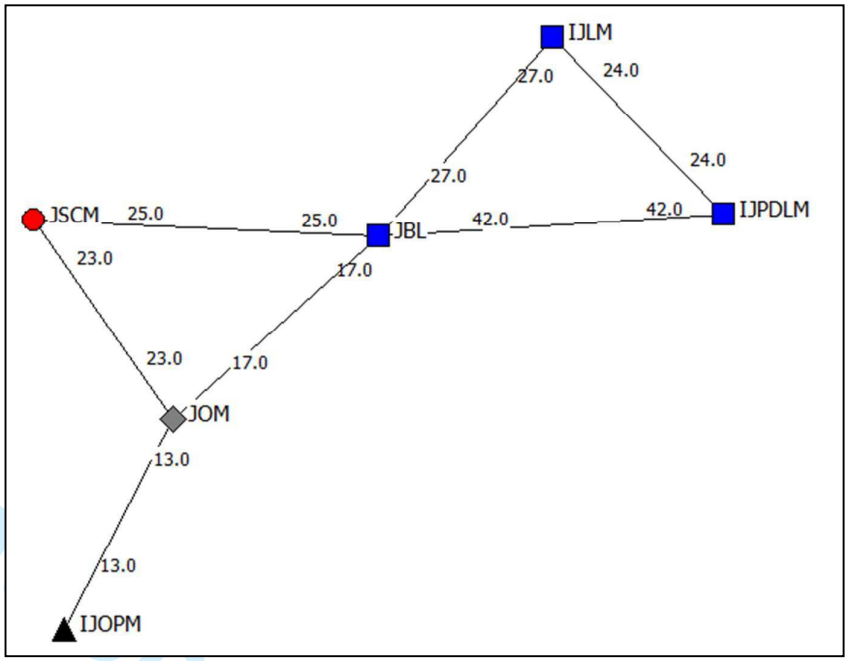

Figure 4(b) Top six journals connected for high strength of tie (greater than 11)

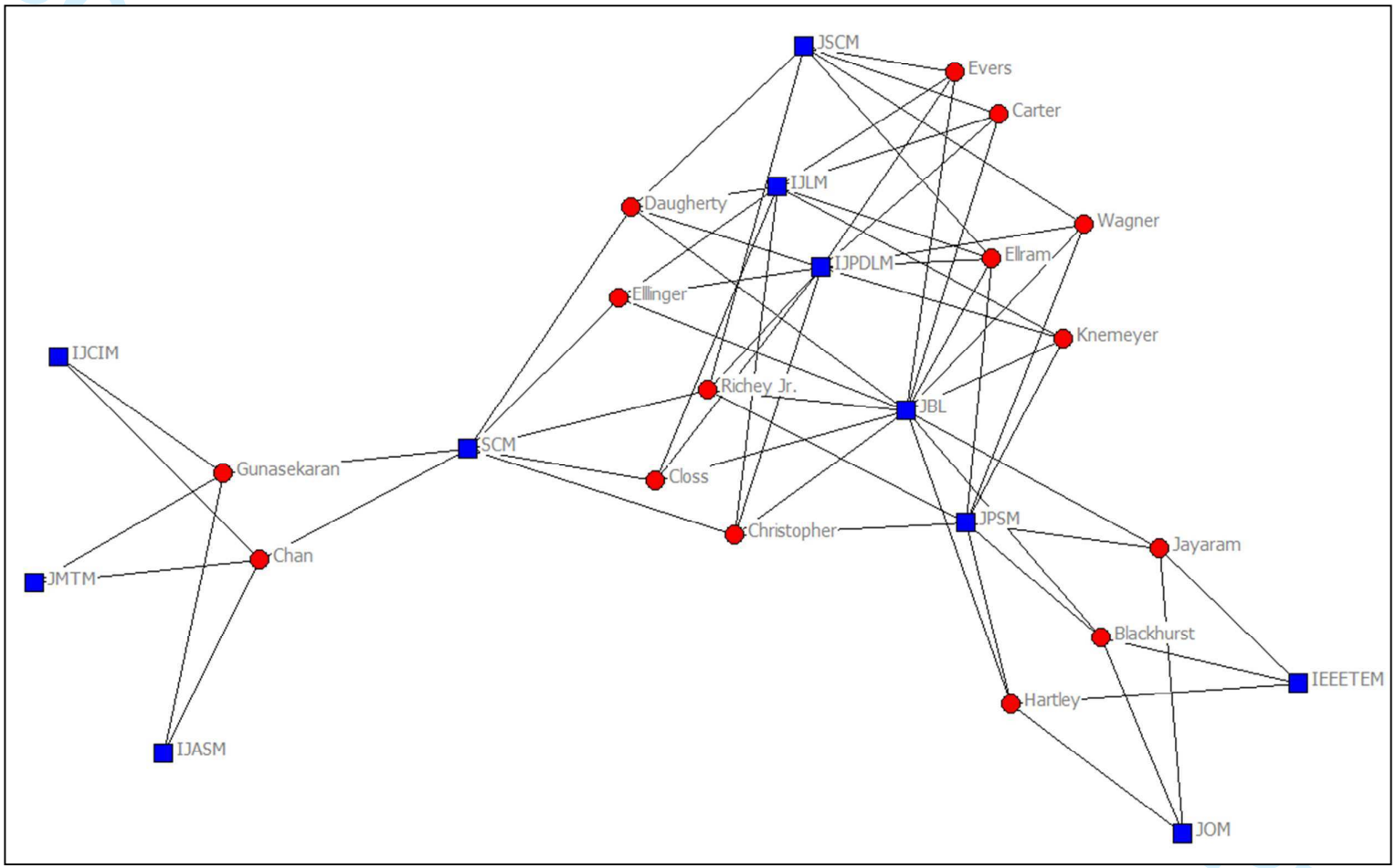

Figure 5 Two-mode analysis of journals and board members for those with four or more board memberships