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A SOCIAL NETWORK PERSPECTIVE OF TOURISM RESEARCH COLLABORATIONS

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Abstract: The structure and the sociology of scientific collaborations are receiving increasing interest, especially in a world characterized by complex problems, dynamic growth of knowledge, and specialized areas of expertise. The primary objective of this study was to explore the patterns of collaborations in tourism research community. To this end, the authors apply social network analysis on co-authorship data obtained from top three tourism journals. The analysis revealed that even though the tourism researcher network is large and complex, it is dispersed in the form of several core groups of researchers who sometimes act as nodes in the network. Further, significant network characteristics, and the sociology behind their significance are presented and discussed. **Keywords:** co-authorship, knowledge networks, scientific collaborations, social network analysis, tourism research.

INTRODUCTION

Development of science is a social process that functions through networks of researchers forming communities. Researchers within a particular scientific community interact and collaborate with one another to contribute to the overall knowledge base of the community. In fact, acceleration of scientific progress in the last few decades has been primarily attributed to the founding of learned societies and improved communication among contemporary researchers (Chang & Harrington, 2005). Knowledge grows through the collaborations within formal academic communities and informal communication facilitated by social networks within these communities (Crane, 1972). The effectiveness of such communities hinges on the strength and extent of relationships among their members. Therefore, an analysis of these communities provides an opportunity to examine the structure of relationships within an academic community (Galison, 1997).

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Further, Academic research contributions, to a very large extent, are known to be products of team work; a fact that becomes most obvious looking at the increasing number of co-authored articles in academic journals (Fox & Faver, 1984). This emphasizes the criticality of collaborations for the growth of academic disciplines, especially in today's world dominated by complex problems, dynamic growth of knowledge, and highly specialized areas of expertise (Haythornthwaite, 2006). Hence, from a research policy perspective, it is important to understand the mechanisms that shape contemporary scientific practices.

A recognition of the importance of these collaborations resulted in the development of tools and methods that provide mathematical and visual evidence of network development and evolution. Social network analysis is one such diagnostic method for studying the mechanisms of communication and collaboration between members in different groups. Applied to a particular domain, this analysis allows one to identify interaction patterns among network members, the number and structure of the sub-groups within the networks, and their organization and evolution (Anklam, 2003). A visual representation of such a network provides for a rich understanding of large and complex communities such as academic researcher groups.

In this study, the authors applied social network analysis to study the patterns of collaborations among the members of tourism academia. No prior studies in the tourism literature have looked into the structure of this academic group with a focus on certain important questions: 'What are the patterns of collaboration within this group?', 'Which groups of researchers collaborate more often with their colleagues to publish in refereed journals?', and 'how did this group evolved over time?' Specifically, the objectives of the study were: 1) To analyze the networks of collaboration among the researchers in the field of tourism research, 2) To identify the key researchers who act as hubs of research in this vast group, and 3) To present various network attributes of this group and study its evolution over two different time periods.

The analysis focused on co-authorship data from three leading tourism journals. The study is in line with previous works by Galison (1997) and Barabási et al. (2002) that analyzed the social structure of research collaborations in the context of other scientific disciplines such as physics and biology and recent study by Hu and Racherla (2008) in the field of hospitality management. Co-authorship of articles in leading journals enables the construction of observable and visual measures of the tourism researcher networks (Newman, 2004). These measures are useful for assessing the impact of network formation, access, and utilization on research productivity, co-authorship networks and relationships.

LITERATURE REVIEW

Sociology of Scientific Collaborations

While studying the structure and patterns of scientific communities, it is necessary to place research collaborations within the broader

framework of the sociology of science and scientific knowledge. Menzel (1966, p. 61) generated early interest in this realm. He observed that scientists can be considered as 'publics': ''*These publics, can, for example, be described in terms of size, in terms of turnover, and in terms of the interactions that exist within them....and in terms of the norms that they have created with regard to exposure to various channels....*''. Menzel also suggested that scientists use these interactions to help themselves with specific activities that form essential parts of their professional and personal lives. Subsequently, numerous researchers attempted to understand the social mechanisms, and the formal and informal communications that support the development of scientific communities.

For instance, Price (1963) and Garvey and Griffith (1971) examined the process of disseminating scientific research results in general and of the journal system in particular. Similarly, Crane (1972) and Cronin and Overfelt (1994) explored the role of social elites, and broadened the context further by showing how the sociology of science provides an interpretive framework for the study of scientific networks, and their impact on the advancement of science.

One of the primary observations can be attributed to Price (1963) and Price and Beaver (1966) who pointed out that scientific literature has been growing exponentially, and has developed some unique trends that reflect the changes in the underlying scientific culture. These studies documented the tremendous increases in the frequency of papers with multiple authors as well as in collaborations between scientists involved in any given research project. However, within these collaborative groups, scientists who are highly visible and socially better connected control more resources and receive more information, acknowledgement and rewards than their less visible or less socially connected peers. (Merton, 1979). Increasing collaborations was also reported by Price and Beaver (1966), Patel (1973) and Fox and Faver (1984) in the context of research funding and grants. It was also attributed to certain inter-scientific factors such as increased communication facilitated by information technology, and the mobility of researchers (Luukkonen, Persson, & Sivertsen, 1992; Luukkonen, Tijssen, Persson, & Sivertsen, 1993).

Price (1963) identified an interesting attribute of academic communities: 'invisible colleges'. These are groups of elite, mutually interacting, and productive scientists from geographically dispersed affiliations who exchange information to monitor progress in their field. Previous research suggested that invisible colleges are fairly organized systems for scientists and that a certain degree of predictable behavior (i.e., information sharing and collaboration) can be found within this system. Bibliometric studies show that scientists involved in invisible colleges typically carry out research within a subject specialty. Most specialties are then made up of sub-topic areas with authors clustered together centrally and peripherally according to shared research interests (Sandstrom, 1994; Zuccala, 2006). As mentioned previously, the development of science occurs through a social process. Groups of closely linked researchers (as in the case of invisible colleges) are

known to be crucial for the advancement of scientific disciplines, and hence, have become of the focal point of researchers in the past few decades.

Research Collaborations and Co-authorships

Recent studies have looked at collaboration networks and structures of scientific communities in the context of varied disciplines such as physics (Barabási et al., 2002; Newman, 2001), computer supported collaborative studies (Cho, Lee, Stefanone, & Gay et al., 2004), management studies (Acedo, Barroso, Casanueva, & Galán, 2006), marketing (Morlacchi, Wilkinson, & Young, 2004), and hospitality management (Hu & Racherla, 2008). These studies have focused on different forms of collaborations such as visiting scholars, interpersonal communication channels, and collaborations on research and writing. Collaborations may be either formal (joint papers, guidance of doctoral dissertations, and participation in research groups) or informal (conferences, research seminars and comments of colleagues, reviewers, and editors) (Laband & Tollison, 2000).

Two methods are generally used to study research collaborations. One of the methods is co-citation analysis wherein links between researchers are established through authors' reference to each other's research and publications (Horn, Finholt, Birnholtz, Motwani, & Jayaraman, 2004; Lin, 1995). Another method is the analysis of co-authorship data. The two methods differ widely in their scope. Citation analysis maps the cognitive structure of the scientific communities, and does not necessarily reflect the social structure and networks formed due to collaborations. As Stokes and Hartley (1989, p. 102) observe, ''*citations, in an academic environment, acknowledge intellectual but not personal debts.*'' On the other hand, co-authorship association between researchers acknowledges both, and therefore provides an opportunity to identify and measure the extent of social activity and influence in scientific specialties. In other words, citation analysis might help identify the central and important scientific papers, whereas co-authorship analysis identifies who the important scientists are.

Hence, this study adopted co-authorship analysis since it directly reflects the social nature and structure of formal relationships among members of the tourism research community. Co-authorship (i.e., collaboration in publishing an article in the top three tourism journals) was used as the descriptor of relationship between researchers, and the primary dimension of interest was the social networks that are created by the collaborations between tourism researchers.

Tourism Research Community

Tremendous growth of tourism as a field of study, coupled with increasing demand for tourism education has led to a heightened focus on research and publications (Jogaratnam, Chon, McCleary, Mena, & Yoo, 2005). Over the last decade, this field has seen the development

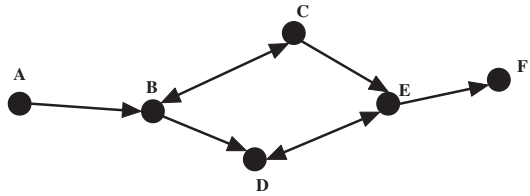
of numerous associations, journals and research consortia, and is linked to groups of researchers in other domains such as business and information technology. On the whole, tourism academia had a significant influence on the way in which this discipline is viewed and practiced. There have been various studies in the past that explored different characteristics of this academic group. These included citation studies, journal ranking studies and content analysis studies (Jogaratnam et al., 2005; McKercher, 2008; Samefink & Rutherford, 2002; Sheldon, 1991; Weaver, McCleary, & Farrar, 1990; Xiao & Smith, 2005). Recently, Tribe (2010) applied the actor-network methodology to explore the nature and structure of the tourism academia. Nearly all of these studies allude to the fact that the tourism academia is dominated by a few prolific researchers who publish in numerous journals, and more than seventy percent of researchers appear only once in any given journal. Primarily, the evidence from these studies points to the assumption that the tourism academia is dominated by dual authored collaborations in isolation and a small networks of highly interconnected researchers who collaborate with one another to repeatedly publish in prominent journals.

However, there are no studies in tourism literature that examined the collaboration patterns of tourism researchers. Tourism research community can also be viewed as a group of individual researchers with a mix of formal and informal mechanisms that enable both face-to-face and technology-mediated communications. These communication mechanisms can be extended to various forms such as visiting researchers, interpersonal communication patterns, and collaboration on research and writing. Such networks of researchers give momentum to the intellectual refinement and advancement of a discipline (Goldman, 1979). Leading tourism research journals provide a major platform for members in the research community to publish and communicate their research to the entire domain (Xiao & Smith, 2005). Such a practice is seriously considered as a major contribution to the knowledge advancement of the field (Jogaratnam et al., 2005). As members of this esteemed community, the authors believe that the effort to investigate the nature and structure of their research community is not only an interesting but also a worthwhile exercise.

METHODOLOGY

Social Network Analysis

Social network analysis is a technique that provides systematic means of assessing networks of relationships by mapping and analyzing relationships among people, teams, departments or even entire organizations. Recent work in the field of network analysis combined with advances in artificial intelligence and information technology have enabled a close examination of large, distributed networks. Specifically, network analysis provides tools to visually represent and examine



	A	B	C	D	E	F
A	0	1	0	0	0	0
B	0	0	1	1	0	0
C	0	1	0	0	1	0
D	0	0	0	0	1	0
E	0	0	0	1	0	1
F	0	0	0	0	0	0

Figure 1. Nodes and Arcs in a Graph with the Relationship Matrix

ecologies of large and complex networks such as academic research communities.

Networks are non-hierarchical forms of organization which evolve as interconnections of individuals engaged in reciprocal, preferential, mutually supportive actions (Burt, 1992). Mathematically, a network is a graph wherein each participant in the network is called an *actor/agent/player* and depicted as a *node* in the graph (Wasserman & Galaskiewicz, 1994). The fundamental objects in these graphs are the set of vertices joined together either in arcs or edges. The arcs (directed links) and edges (bi-directed or undirected links) represent the relationships (such as frequency of communication, workflow exchanges, or in this case, co-authorship) within the members. For example, the graph depicted in Figure 1 has the vertex set V = {A, B, C, D, E, F} and an edge set E = {(A, B), (B, C), (C, D), (C, E), (D, E)}. The focus of social network analysis is on relationships between actors and not individual properties of the members of the network.

Three kinds of networks are generally investigated through networks analysis: ego-centric, socio-centric, and open-system. Ego-centric networks are those networks that are connected with a single node or individual (e.g., all the good friends of vertex A). Socio-centric networks involve networks in a box. Examples of such networks include relationships between executives in an organization, or between researchers of a particular domain. The boundaries of such systems are generally well defined and the fine points of the network structure are generally studied. In open-systems, the boundaries of the network are generally not well defined (for e.g., the elite in a country or society or links between corporations). Academic communities can be considered as a hybrid of all the three types of networks due to the inherent inter-disciplinary nature, and collaborative nature of academic research (Newman, 2001). To examine such complex networks, network analysis provides mathematical definitions of five central characteristics: cohesion, equivalence (role-groups), power of actors, range of influence, and brokerage (Bonacich, 1987; Burt, 1992). These characteristics are expressed in terms of corresponding network-structure parameters derived from the relations among the actors.

Data Collection

Newman (2001) studied networks of scientists in which two scientists are considered connected if they have coauthored a paper. His assumption is

based on a reasonable definition of scientific acquaintance: most people who have written a paper together will know one another quite well. Such a stringent condition of acquaintance is acceptable if it is applied consistently throughout data collection. In this study, the primary unit of analysis was a published article or research paper and the relationship analyzed was the co-authorship. As mentioned previously, the nodes are the authors and the links between nodes are the papers jointly authored by them. The population of interest was all the authors who have contributed research articles to three prominent tourism journals over a period of 10 years, starting from the year 1996 till 2005.

Short communications, editorials, and book reviews were not included in the final analysis since the primary focus in this study was research contribution. The list of journals considered was based on Pechlaner, Zehrer, Matzler, and Abfalter (2004) study that ranked various tourism journals based on impact factors. The top three tourism journals, *Annals of Tourism Research*, *Journal of Travel Research*, and *Tourism Management* were chosen for this study since they were consistently ranked as the top three journals in similar studies. All the articles were first downloaded from their respective databases into a reference manager. After initial data cleaning, the records were exported to a spreadsheet and used for the analysis. For each record, the following variables were collected: article title, authors' names, and year of publication, journal name, keywords, and abstract. The records were independently verified by the authors to eliminate duplications and errors.

In total, the dataset consisted of 1181 articles and 1393 authors. The number of papers analyzed for the time period 1996–2000 amounted to approximately 476, and for the time period 2000–05 were 705. The number of the authors analyzed for the time period 1996–2000 was 521, and that for the 2001–05 was 872. Approximately 28% were single author papers whereas the remaining 72% of the papers had two or more authors. The basic descriptive statistics of the data set are shown in Table 1.

One of the important aspects of the analysis is the categorization of the authors into predefined research streams. This enabled the authors to analyze collaborations between authors in the context a specific research streams. The keywords and the abstract, combined with the title were used to categorize journal articles into various research streams. For instance, research articles with the words segmentation, cluster analysis, typology or likewise in the title, key words or the abstract were categorized as 'segmentation' studies. If one author had multiple

Table 1. Description of the Data

Attribute	Period 96–00	Period 01–05	Total
Number of Articles	476	705	1181
Number of Authors	521	872	1393
Number of Collaborations	365	722	1078
Single Authored Papers	199	229	428

Table 2. Research Stream Categories

ID	Category Description
1	Segmentation & Tourist behavior studies
2	Marketing & Strategy
3	Information & Communication Technology
4	Sustainable/Eco/Green & Alternative Tourism
5	Industry studies/Performance & Impact studies
6	Forecasting & Community Studies
7	Hospitality & Gaming
8	Human resources, Training, Education & Research
9	Travel industry/Airlines/Others

papers in more than one research stream, the categorization was based on the majority of the articles in a stream. For instance, if an author had three articles in the 'segmentation' stream and one article in 'industry/performance studies' stream, the author was categorized into the 'segmentation stream. Once an initial coding sheet for the research streams was prepared, the researchers independently coded a random sample of two hundred articles. The coding was later reconciled to develop a robust research stream categorization. The nine research streams identified for the analysis are indicated in Table 2.

This methodology has two significant improvements over that employed by similar studies in the past. First was the inclusion of single collaborations. Previous studies in collaboration networks (Morlacchi et al., 2004) included only those authors who have published with more than three co-authors. Although this methodology increases the robustness of the network analysis, the isolates that have been eliminated may play an important role in connecting various sub-groups to the main network. Second was the emphasis on studying the dynamics and evolution of the networks. Collaboration networks are a prototype of evolving networks, where the emphasis is on dynamics and growth. Co-authorship networks constantly expand by addition of new authors to the domain as well as the addition of new internal links within already existing authors. By comparing the collaborations in two time periods, the topology of these network dynamics can be effectively captured.

However, one of the limitations of the methodology is the omission of single author articles. The ideas and research contributions of single authors do play an important role in shaping the intellectual directions of the tourism research group. For example, the data set consisted of many researchers who have published more than three single authored papers each, in a given time period. However, since the primary focus was the co-authorship, the methodology required that single authored papers (also known as *loops* in the network analysis terminology) be omitted from the analysis. But, prolific single authors also tend to publish a significant number of articles in collaboration with other researchers, thereby mitigating the exclusion of key researchers from

the network map. Another operational difficulty associated with the methodology was the research stream categorization, which could be characterized as subjective. Since the journals do not provide a classification system of research streams, the authors used their own judgment to distinguish various research streams and categorize the articles and authors accordingly.

ANALYSIS AND RESULTS

Distribution of the Co-authorships

The primary goal of the analysis was to extract parameters that are crucial to understanding the topology of the tourism researcher group. A quantity that has been much studied for various networks is the distribution given the probability P (k) that a randomly selected node has at least k links (Barabási et al., 2002). The distribution of number of co-authorships for both the time periods showed a characteristic power law distribution, and not a normal or bell shaped distribution (see Figure 2). Power law distribution indicates that few authors are involved in large number of co-authorships, and there is a long tail with many authors having just one or two co-authors. This aspect conforms to results from previous studies (Barabási & Albert, 1999; Newman, 2001) that established power law distribution as a characteristic feature of large and evolving collaborative networks. Two factors are predominantly responsible for this distribution: 1) networks continuously grow with the addition of new vertices (in this case, authors), and 2) vertices connect preferentially to highly connected vertices. A combination of growth and preferential attachment is ultimately responsible for the power-law distribution seen in large communities.

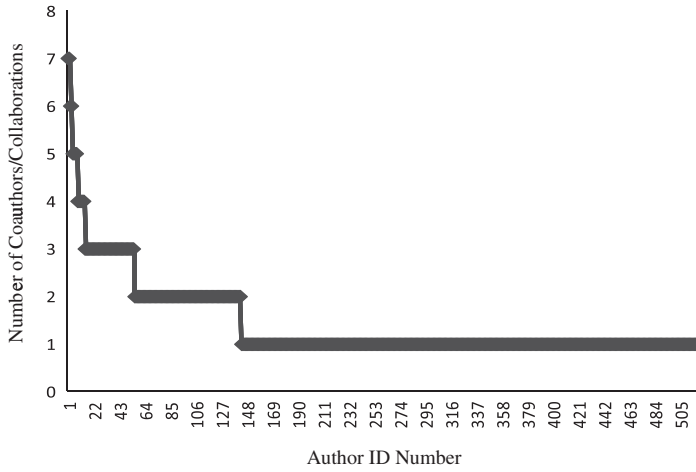


Figure 2. Power-law Distribution of Co-authorships for the Time Period 1996–2000

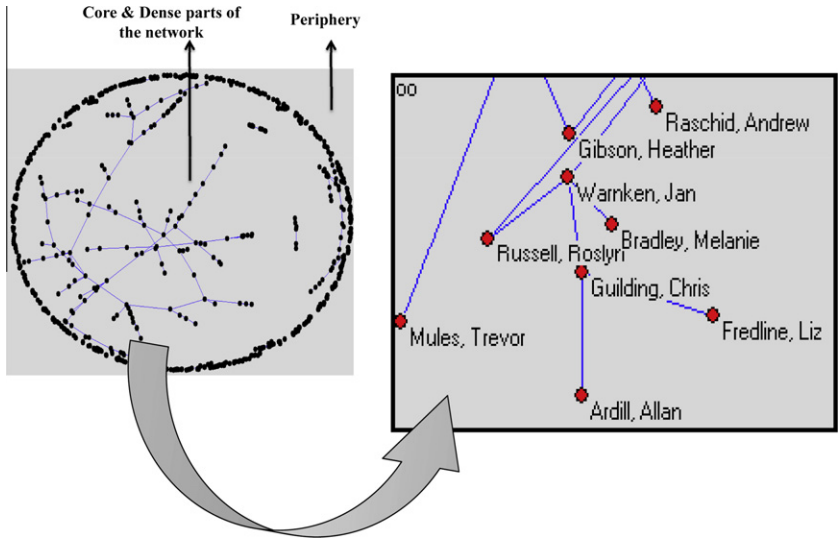


Figure 3. Total Tourism Researcher Network from 1996–2005

The overall pattern of researcher to researcher connections for the time period 1996–2005 is shown in Figure 3. As mentioned earlier, the network is defined by *nodes* and *arcs*. Each node or vertex represents a single author and the link/s between the nodes denoted by an arc (directed arrow). In the network, if two authors are linked by a line, then they must have coauthored at least one paper. Further, if an arc is directed from one author to another, then the former author is the first author and the latter, the second author. This dominant giant network is used for further analysis. The pattern of network connections indicates the presence of a ''core-periphery structure'' (Borgatti & Everett, 2000), where a core network is ''branched-in'' toward the centers (most collaborative authors) from a peripheral network (outer layer). A preliminary observation of the data showed an increase of collaborations in the time period 00–05 as compared to the 96–00 period. Interestingly, links in the network were observed to be branching out from the main core-periphery structure.

Separate Component Analysis

The overall network was further delineated into separate components based on the number of members that collaborated to publish in the top journals (see Figure 4). It indicates that there is a relatively large group of researchers who are interconnected in a cohesive network. At the same time, the separate components analysis shows the existence of a large number of isolated dual collaborations and subgroups with less than four researchers and subgroups. The subgroups can be groups of authors who have published articles based on

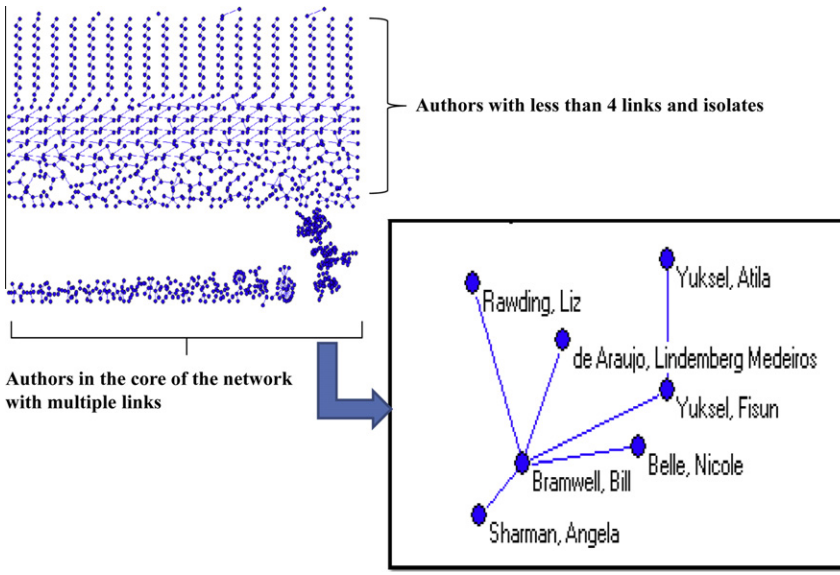


Figure 4. The Overall Network Broken Down into Separate Components

collaborations with each other. Some of the isolates can be indirectly connected to the main network through the co-author links. This evidence supports the observation by recent studies (Jogaratnam et al., 2005; McKercher, 2008) that more than three quarters of the authors that published in top journals tend to appear only once and the network that characterizes large academic groups is actually a combination of numerous sub-groups of researchers that work in isolation and a smaller group of researchers that are highly interconnected and publish frequently in the top journals. However, it should be noted that isolates and subgroups are an inherent feature of networks.

The importance of the ties connecting different groups (core and periphery) was first reflected upon by Granovetter (1973) in his now famous article ''strength of weak ties''. Weak ties concept describes the nature of relationships between the members of a network, and their impact on the entire network. Weak ties serve as bridges between densely knitted groups of people in a network. Therefore, even though weak ties imply a low density network (one in which many possible ties are absent), they are important for the flow of information and resources in the network. Any particular node will have a collection of close friends who are in touch with each other (strong ties). But each of these friends will have friends in his/her own right, and are part of different closely knit groups. These different groups will not be connected if not for the indirect relationships (weak ties). Weak ties help integrate different parts of the social system and facilitate flow of information from otherwise distant parts of the network.

Network Density and Centrality Measures

An important characteristic of collaborative networks is the relationships of individuals scattered around the network. In network analysis, the density of network captures the idea of cohesion. Density is defined as the number of arcs (directed relationships) in a network, expressed as a proportion of the maximum possible relationships (Nooy, Mrvar, & Batagelj, 2005). It is calculated as the number of arcs, '*L*', divided by the possible number of arcs. Since an arc is an ordered pair of vertices, there will be only $n(n-1)$ total possible arcs, with n being the total number of vertices in the network (see Equation 1). Density of any network is a fraction that ranges from a minimum of 0 to a maximum of 1, when all arcs are present.

$$\Delta = L/n(n-1) \tag{1}$$

The density of the tourism researchers' network in the time periods 96–00 and 01–05 was a very low *0.0010981* and *0.0007119* respectively. Although, it is obvious that higher the density, higher is the overall cohesion of the network, it should also be noted that the low density is inherent in large networks as it is inversely related to the network size. It is improbable that an author would publish with many others in a network.

A better measure of network cohesiveness is **c**entrality metrics that reflect the prominence of actors in a network. An actor is prominent if his/her ties make the actor visible to the other actors in the network (Knoke & Burt, 1983). Prominence should be measured by not only looking at direct and adjacent ties but also the indirect paths involving the intermediaries. This study adopted three common centrality measures: degree, closeness, and betweenness centrality (Wasserman and Faust, 1994). Degree centrality of an actor is the total number of links that are adjacent to this node. Degree centrality represents the simplest instantiation of the notion of centrality since it measures how many connections tie authors to their immediate neighbors in the network.

However, authors may be well connected to their immediate neighbors but be part of a relatively isolated group that is, even though an actor is well connected, overall centrality is low. Closeness centrality therefore expands the definition of degree centrality by focusing on how close an author is to all other authors. To calculate closeness centrality an actor's shortest-path distances to all authors in the network should be determined and inverted to a metric of closeness. An author with high closeness centrality is characterized by many, short connections to other authors in the networks. Betweenness centrality represents a different aspect of centrality. It is based on determining how often a particular node is found on the shortest path between any pair of nodes in the network. Nodes that are often on the shortest-path between other nodes are deemed highly central because they control the flow of information in the network. Betweenness centrality can be used in disconnected networks; however it may generate a large number of nodes with zero centrality, since many nodes may not act as a bridge in

Table 3. Authors' Ranking Based on Centrality Metrics

Rank	Author	Degree		Closeness		Betweenness
1	Pizam, A	14	Sonmez, S.	22	Sirakaya, E	12
2	Sirakaya, E	12	Sirakaya, E.	22	Graefe, A	11
3	Witt, S	12	Graefe, A	22	Sonmez, S	11
4	McKercher, B	10	Uysal, M	21	Petrick, J	10
5	Gursoy, D	9	Nyaupane, G	21	Uysal, M	10
6	Lee, C	9	Morais, D	21	Morais, D	10
7	Fesenmaier, D	9	Gursoy, D	20	Backman, S	10
8	Crompton, J.	8	Backman, S	20	Nyaupane, G	10
9	Ryan, C	8	Chen, J	20	Kim, S	10
10	Andereck, K	7	Yoon, Y	20	Gursoy, D	8
11	Faulkner, B	7	Petrick, J	20	Kim, K	6
12	Kim, S	7	Sasidharan, V	19	McGehee, N	6
13	Page, S	7	Woodside, A.	19	Andereck, K	6
14	Uysal, M	7	Sonmez, S	19	Prideaux, B	5
15	Bigne, J.E.	6	Apostolopoulos, Y	19	Lee, C	4

Table 4. Groups Classified by the Number of Collaborations

No. of Collaborations	Freq. (96–00)	Sample Representative	Freq. (01–05)	Sample Representative
1	389	Adamowicz	594	Akama
2	80	Andersen	150	Gilbert
3	37	Airey	61	Bonn
4	7	Law	34	Baloglu
5	4	Prentice	14	Aguilo
6	4	Crompton	6	Andereck
7			3	Hudson
8			3	Bigne
9			1	Kim
10			2	Gursoy
11			2	Sirakaya
12			1	McKercher
14			1	Pizam
Sum	591		872	

the network. The results are shown in Table 3. Researchers are ranked based on their centrality metrics. Further, the researchers with their collaborations for both the time periods are shown in Table 4.

The results show a power law distribution with few authors showing a high degree of connections and majority of the authors (more than 78%) having very low centrality measures. It is interesting to note the difference in author ranks based on degree and closeness and betweenness. For instance, only few of the prominent authors that were shown

Table 5. Number of Collaborators of the Most Prolific Researchers

Researcher	*Productivity Rank (1992–2001)	No. of Articles (1996–2005)	Number of Collaborators (1996–2005)
Crompton, John	1	10	10
Fesenmaier, Daniel	2	12	9
Ryan, Chris	3	15	10
Opperman, Martin	4	7	1
Pearce, Douglas	5	9	3
Pizam, Abraham	6	10	14
Uysal, Muzaffer	6	8	5
Prentice, Richard	6	10	10
Witt, Stephen	9	11	11
Faulkner, Bill	10	11	9

* Productivity rank in time period 1992–2001 as measured by Jogaratnam et al. (2005).

in previous analyses appear in the top ranks when their closeness and betweenness metrics are taken into consideration. The immediate conclusion that can drawn from these results is that the elite authors of the field tend to work within relatively closely knit yet isolated subgroups and do not play a key role in bringing together disparate groups in the overall network.

Cohesive Groups and Research Productivity

The above analysis leads to an important question: ''do research collaborations lead to researcher productivity?'' Collaboration networks usually contain dense pockets of individual researchers who collaborate within the same group. Such groups are termed as cohesive subgroups (Nooy et al., 2005). An interesting fall out of cohesive subgroups is ''appreciation''. According to Woodruff (1999), cohesion enhances the appreciation of each of its members. The more appreciation group members have for each other, the more they will interact. Interaction, being a glue factor, will further reinforce cohesion. The production of knowledge is a social process involving interactions among people with different backgrounds, predispositions and insights. The members of such subgroups interact, develop, and exchange new knowledge, and in the process contribute to and shape the community over a period of time (Wenger, 1998). To test this assumption, this study calculated the number of collaborations of the most prolific researchers as identified by Jogaratnam et al. (2005). The results are shown in Table 5.

The results in Table 4 show that there is a significant correlation between the researchers' extent (number) of collaborations and their research productivity (as measured by the number of articles in the three journals) (The only exception being Opperman, M., who published more single authored papers).

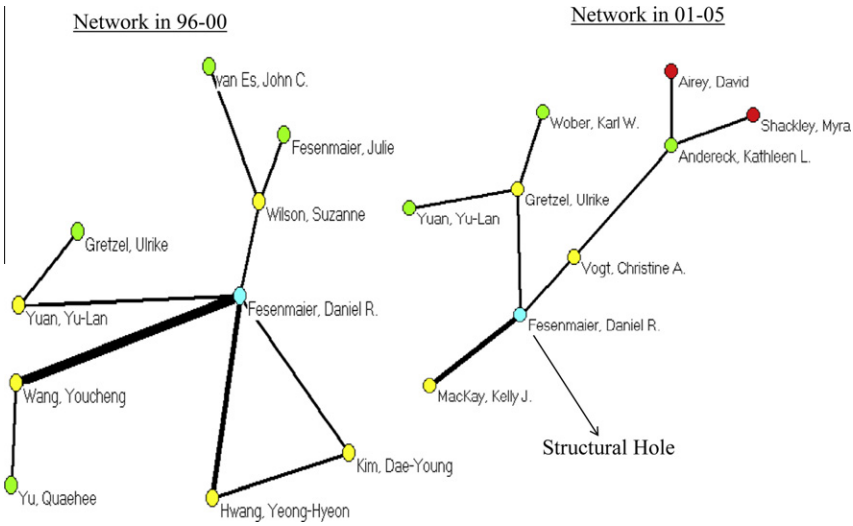


Figure 5. The Cohesive Subgroup of Fesenmaier, D. in the Two Time Periods

Structural Holes and Social Capital

The above evidence also emphasizes on the importance of social capital accrued by the virtue of being the focal point in a cohesive subgroup. A 'structural hole' is measured in terms of the effective size of the central node's co-authorship group that is, the strength of the subgroup is dependent on the direct links and indirect links between the nodes other than the central node (Burt, 1992). In social stratification studies (Lin, 1995; Tsai & Ghoshal, 1998), the position of a structural hole is directly related to gaining social capital, the ability of the central node to take advantage of the position, and draw on the resources contained by members of the network. It also indicates how important a researcher's role is in linking together researchers of the network. This ability to act as a 'broker' depends on the extent and shape of one's network, the resources available to the members of the network, and most importantly, on the central node's ability to make connections between other nodes in the network. This study explored the cohesive subgroups of two researchers randomly chosen from Table 4.

For example, Dr. Daniel Fesenmaier, who is currently affiliated with Temple University, has collaborated with more than nine researchers in the tourism domain, and as a result has published twelve research articles in 96–05 time period. Further, his collaborations have extended to researchers from both USA as well as other parts of the world. This key researcher therefore played an important role in bringing numerous researchers from geographically dispersed institutions towards a common goal of knowledge generation. The benefits of the social capital accrued from the collaborations are also

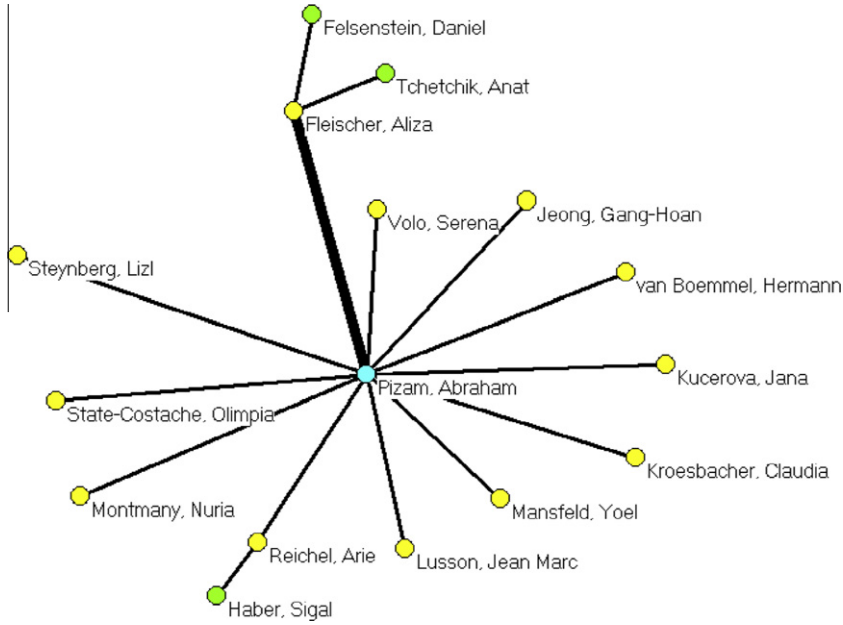


Figure 6. The Cohesive Subgroup of Pizam, A. in the Time Period 01–05

evident. In the case of Dr. Fesenmaier, majority of his collaborators were his PhD students who have continued working with him over a long period of time. Further, these collaborations have led to the formation of new links that have benefitted the focal researcher at a later stage. For instance, one of Dr. Fesenmaier's doctoral students, Dr. Gretzel, worked with Dr. Karl Wober, a researcher from Austria. While this formed an indirect link in the focal time period, it has lead to direct research collaboration between the two researchers resulting in a publication in a leading journal as well as a transnational research project. This simple example emphasizes the importance of geographical and institutional proximity in the sustenance of research collaborations as well as the importance of weak ties for the advancement of scientific knowledge. Similarly, Dr. Abraham Pizam, a prolific researcher from University of Central Florida has contributed more than ten publications resulting from collaborations with researchers across the country.

The subgroup of both the researchers has also grown substantially in the 01–05 period, with more than ten direct links and many other indirect links (see Figures 5 and 6). (If a researcher has a direct collaboration with the central node, it is shown as a one step distance. Other researchers connected to the coauthors are represented by distance of two and three steps.). It should be noted that the number of links between the nodes other than the central node is very minimal, emphasizing the pivotal role played by the structural holes in bringing

Table 6. Number of Authors in Research Streams

Research Stream	Freq (96–00)	Sample Representative	Freq (01–05)	Sample Representative
Segmentation studies	104	Ankomah, PK.	153	Lo, A.
Marketing & Strategy	70	Andersen, V.	162	Riege, AM.
Information & Communication Technology	18	Caro, JL.	35	Beldona, S.
Sustainable/Eco/Green/ Alternative Tourism	62	Berry, S.	99	Aas, C.
Industry/Performance & Impact studies	113	Adamowicz, WL.	203	Douglas, A.
Forecasting & Community Studies	91	Andereck, KL.	98	Aguilo, E.
Hospitality & Gaming	15	Callan, R.	42	Capiez, A.
Human resources, Training, Education & Research	35	Airey, D.	40	Woodside, A.
Travel industry/Airlines/ Others	12	Crotts, JC.	35	Butler, DL.
	521		872	

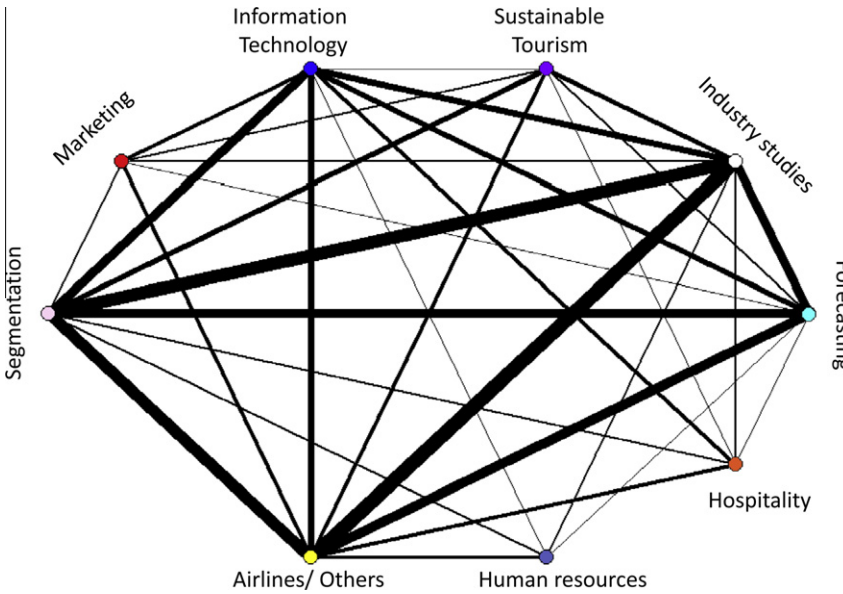


Figure 7. Global View of Collaborations in Time Period 01–05

people together in a network. It is quite noticeable that the average degree of centralization of these researchers is substantially higher than the degree of the entire network.

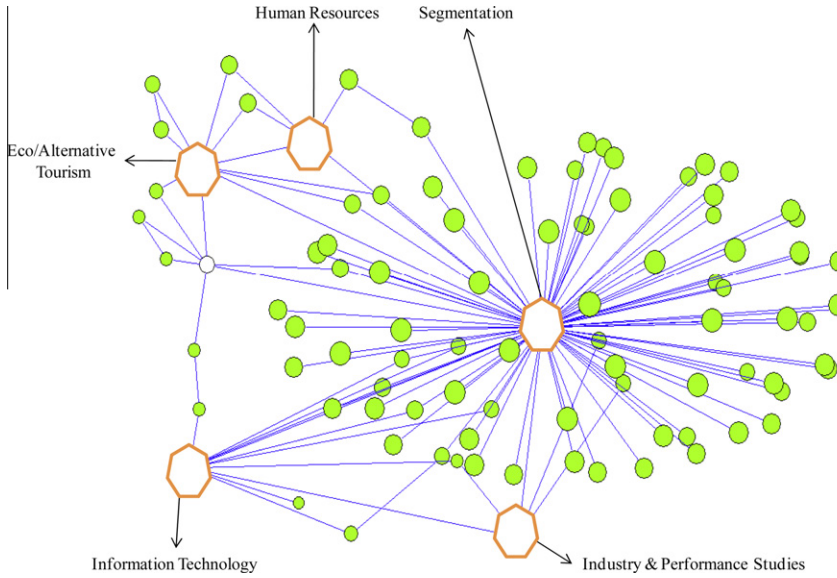


Figure 8. Contextual View of the 96–00 "Marketing" Group's Collaborations with Other Research Streams

Network Reduction

Network reduction is an interesting process through which large networks can be systematically divided into mutually exclusive sub-networks. It enables a closer look at such sub-networks within complex networks such as the tourism researcher network. In this analysis, the network was reduced in three ways, namely global, local, and contextual views. As mentioned previously, the researchers were categorized into nine research streams. Table 6 lists the research streams and their number composition for both the time periods.

Figure 7 shows the global view of how research collaborations among different streams are directionally linked and to which research streams the leading co-authors (i.e., first authors) belong (The thickness of the connecting links reflects the extent of collaboration). For example, in the 01–05 time period, ''Marketing'' researchers (stream two) as leading authors initiated collaboration with their ''Segmentation'' (stream one) colleagues. Also, there were more collaborations between ''Industry studies'' (Stream five) group and ''forecasting studies'' groups than any other two groups. Furthermore, the collaboration patterns were examined by expanding individual researchers in one research stream (e.g., ''Marketing'' in Figure 8). Also termed as the local view, it provides us a snapshot of the co-authorship patterns and structural holes exclusively within the ''Marketing'' group.

To explore the collaborations between researchers of the 'marketing' group and various other research streams, Figure 8 provides a contextual view of the network. Nodes have been labeled with different

shapes to enable easy identification. The circular nodes in the light shades are the researchers categorized into the marketing & strategy stream, whereas the larger hexagonal shaped nodes indicate different research streams. Such an expansion provides a contextual view of how individual researchers in one particular research stream collaborate with other researchers in different streams within the knowledge domain. For instance, Fletcher, J. who published in ''Marketing'' has more than three collaborations with other streams of research. This implies that Dr. Fletcher serves as a critical node to link marketing stream with other research streams.

DISCUSSION AND CONCLUSIONS

This study explores the collaboration networks among tourism researchers using co-authorship data. Co-authorship networks provide a copious and meticulously documented record of the social and professional relationships in an academic discipline. Given the social nature of academic research, it is only reasonable to apply social network analysis to map and study the collaboration patterns within the tourism research community. The results are significant for several reasons. What is the structure of collaboration networks in tourism research community? What is the impact of particular groups and subgroups? How have these structures changed overtime? This study attempted to answer some of these interesting questions.

The analysis shows that tourism academia is, in many ways, still evolving the rich networks of collaboration common in other scientific enterprises. The power law distribution and the separate component analysis of the network indicate a rich tapestry of collaborations across both institutional and geographical boundaries, but demonstrate a significantly higher degree of clustering and dispersion when compared to other domains. Tourism academia has numerous single paper collaborations and less large components which indicate that researchers collaborate closely within specific clusters but restrict their collaborations to specific groups of interest. This result could be an artifact of any of the following factors: a) the relative immaturity of the field when compared with other established fields such as sociology and management studies (Acedo et al., 2006), and b) the multidisciplinary nature of the tourism research, and c) limited international collaboration. This situation has led to a fragmentation in the social network with clearly defined clusters and isolates and with little collaboration among them.

The cohesive subgroup analysis shows that the neighborhood size of the most prominent and productive researchers is relatively limited. This gives credence to Echtner and Jamal's (1997) call for a dominant paradigm in tourism. Social networks are essential to knowledge creation. In theory, it would be logical to assume that elite researchers in a field represent different paradigms and approaches (Pfeffer, 1993) and that these researchers come together to drive the dominant paradigm by combining approaches from their respective disciplines, This is especially important in fragmented domains such as tourism.

However, the results show that this is not the case in tourism. In fact, the most prominent researchers sometimes do not show high degree of closeness and centrality (the measure of how well they connect disparate groups in the network).

Do these results mean that networks are less valued in tourism research? The analysis shows that developing a network of collaborations/collaborators is highly beneficial to researchers as evidenced by the fact that researchers with multiple collaborations usually tend be the most productive researchers in the field. At the same time, this result can be stochastic in the sense that people prefer to collaborate with highly productive researchers and this further increases the network size surrounding a productive researcher. The results also show that the boundaries of varied research streams are relatively permeable thereby assisting in inter-disciplinary collaboration. As of now, the collaborations seem to be dominant among closely related groups (e.g., segmentation and marketing & strategy) but the results are a growing trend in the positive direction. This result, however, should be interpreted with caution since the analysis is not specifically designed to answer this question.

FUTURE RESEARCH DIRECTIONS

The Results Point to Three Specific Directions for Future Research

The origin and maintenance of research collaborations is a topic that requires focus from future researchers. For instance, the growing sophistication of information and communication technology as well as cheaper and faster transportation has revolutionized the way people communicate and collaborate. In addition, funding and research agencies are increasingly insisting on cross-functional as well transnational collaboration (Melin, 2000). The impact of these factors on researcher collaborations should be an important area of interest in this field. Primarily, the question that should be explored is: ''*what are the structural, social and individual factors that impact the development, sustenance and success of research collaborations?* Understanding this phenomenon is highly beneficial to the growth of a field.

Another aspect of interest could be the impact of geographical/institutional proximity or lack thereof on research collaborations. Preliminary evidence in this study seems to suggest that institutional or geographical proximity does lead to the formation of cohesive researcher groups. Future research can also map these networks based on their geographical dispersion. It will give us an idea on the dynamics of research groups in various parts of the world (Xiao & Smith, 2008). Related to this is the importance of researchers who act as hubs in the field of tourism. These hubs, also referred to as structural holes, play an important role in brokering information and acting as central conduits for both information and resources that are critical to the success of research projects. While this study, to an extent, explores the role of the researchers in the hub positions, it is still not clear if their absence either due to retirement or inactivity impacts the advancement

of the field. Future researchers must carefully construct time-dependent data to assess the important roles played by structural holes.

Social networks are seen as primary enablers of information and knowledge exchange. Recent advances in information technology have revolutionized the way these networks are maintained. Network data can be a rich source to understand and develop effective social networking aids that can drive the collaborations between the tourism research communities (Cooper, 2006). Further, social network data can also be used to identify research gaps, such as synergistic research programs that benefit from academic collaborations. This is another area ripe for research in the field of tourism. The study of complex adaptive systems is a growing area of interest with new tools and techniques such as social network analysis being developed every day. This study is the first step in this direction and will pave way for understanding the growth of knowledge networks and social capital in the tourism domain. A

REFERENCES

Acedo, F. J., Barroso, C., Casanueva, C., & Galán, J. L. (2006). Co-authorship in management and organizational studies: an empirical and network analysis. *Journal of Management Studies, 43*(5), 957.

Anklam, P. (2003). Tapping social networks to leverage knowledge and innovation. *Information Today*, 81–93.

Barabási, A.-L., & Albert, R. (1999). Emergence of scaling in random networks. *Science, 286*(5439), 509–512.

Barabási, A.-L., Jeong, H., Néda, Z., Ravasz, E., Schubert, A., & Vicsek, T. (2002). Evolution of the social network of scientific collaborations. *Physica A: Statistical Mechanics and its Applications, 311*(3–4), 590–614.

Bonacich, P. (1987). Power and centrality. *American Journal of Sociology, 92*(1), 1170–1182.

Borgatti, S. P., & Everett, M. G. (2000). Models of core/periphery structures. *Social Networks, 21*(4), 375–395.

Burt, R. S. (1992). *Structural holes*. Cambridge, MA: Harvard University Press.

Chang, M.-H., & Harrington, J. E. Jr., (2005). Discovery and diffusion of knowledge in an endogenous social network. *American Journal of Sociology, 110*(4), 937–976.

Cho, H., Lee, J. S., Stefanone, M., & Gay, G. (2005). Development of computer-supported collaborative social networks in a distributed learning community. *Behaviour & Information Technology, 24*(2), 435–447.

Cooper, C. (2006). Knowledge management and tourism. *Annals of Tourism Research, 33*(1), 47–64.

Crane, D. (1972). *Invisible colleges: Diffusion of knowledge in scientific communities*. Chicago, Illinois: University of Chicago Press.

Cronin, B., & Overfelt, K. (1994). The scholar's courtesy: A survey of acknowledgement behaviour. *Journal of Documentation, 50*, 165–167.

Echtner, C. M., & Jamal, T. B. (1997). The disciplinary dilemma of tourism studies. *Annals of Tourism Research, 24*(4), 868–883.

Fox, M. F., & Faver, C. A. (1984). Independence and cooperation in research: The motivation and costs of collaboration. *The Journal of Higher Education, 55*(3), 347–359.

Galison, P. L. (1997). *Image and logic: A material culture of micro-physics*. Chicago, IL: University of Chicago Press.

Garvey, W. D., & Griffith, B. C. (1971). Scientific communication: Its role in the conduct of research and creation of knowledge. *American Psychologist, 26*(4), 349–362.

Goldman, A. (1979). What is justified belief?. In G. Pappas (Ed.), *Justification and Knowledge* (pp. 1–23). Reidel: Dordrecht.
Granovetter, M. S. (1973). The strength of weak ties. *American Journal of Sociology, 78*(6), 1360–1380.
Haythornthwaite, C. (2006). Learning and knowledge networks in interdisciplinary collaborations. *Journal of American Society for Information Science and Technology, 57*(8), 1079–1092.
Horn, D. B., Finholt, T. A., Birnholtz, J. P., Motwani, D., & Jayaraman, S. (2004). Six degrees of Jonathan Grudin: A social network analysis of the evolution and impact of CSCW research. Paper presented at the *ACM conference on computer supported cooperative work*, New York, NY.
Hu, C., & Racherla, P. (2008). Visual representation of knowledge networks: A social network analysis of hospitality research domain. *International Journal of Hospitality Management, 27*(2), 302–312.
Jogaratnam, G., Chon, K., McCleary, K., Mena, M., & Yoo, J. (2005). An analysis of institutional contributors to three major academic tourism journals: 1992–2001. *Tourism Management, 26*(5), 641–648.
Knoke, D., & Burt, R. S. (1983). Prominence. In R. S. Burt & M. Minor (Eds.), *Applied network analysis* (pp. 195–222). Beverly Hills, CA: Sage.
Laband, D. N., & Tollison, R. D. (2000). Intellectual collaboration. *Journal of Political Economy, 108*(3), 632–662.
Lin, C. H. (1995). The cross-citation analysis of selected marketing journals. *Journal of Management, 12*(3), 465–489.
Luukkonen, T., Persson, O., & Sivertsen, G. (1992). Understanding patterns of international scientific collaboration. *Science, Technology & Human Values, 17*(1), 101.
Luukkonen, T., Tijssen, R. J. W., Persson, O., & Sivertsen, G. (1993). The measurement of international scientific collaboration. *Scientometrics, 28*(1), 15–36.
McKercher, B. (2008). A citation analysis of tourism scholars. *Tourism Management, 29*(6), 1226–1232.
Melin, G. (2000). Pragmatism and self-organization Research collaboration on the individual level. *Research Policy, 29*(1), 31–40.
Menzel, H. (1966). Information needs and uses in science and technology. *Annual Review of Information Science and Technology, 1*, 41–69.
Merton, R. K. (1979). *The sociology of science: Theoretical and empirical investigations.* University of Chicago Press.
Morlacchi, P., Wilkinson, I. F., & Young, L. (2004, May). Social networks of researchers in business to business marketing. *A case study of the IMP Group 1984–1999.* Retrieved December 3, 2005, from <http://www.sussex.ac.uk/spru/documents/sewp116.pdf>.
Newman, M. E. J. (2001). The structure of scientific collaboration networks. *Proceedings of the National Academy of Sciences (PNAS), 98*(2), 404–409.
Newman, M. E. J. (2004). Coauthorship networks and patterns of scientific collaboration. *Proceedings of the National Academy of Sciences (PNAS), 101*(S1), 5200–5205.
Nooy, W., Mrvar, A., & Batagelj, V. (Eds.). (2005). *Exploratory social network analysis with Pajek.* New York, NY: Cambridge University Press.
Patel, N. (1973). Collaboration in the professional growth of American sociology. *Social Science Information, 12*(6), 77–92.
Pechlaner, H., Zehrer, A., Matzler, K., & Abfalter, D. (2004). A ranking of international tourism and hospitality journals. *Journal of Travel Research, 42*(4), 328–332.
Pfeffer, J. (1993). Barriers to the advance of organizational science. Paradigm development as a dependent variable. *The Academy of Management Review, 18*(4), 599–620.
Price, D. J. (1963). *Little science, big science.* New York, NY: Columbia Univ. Press.
Price, D. J. S., & Beaver, D. (1966). Collaboration in an invisible college. *American Psychologist, 21*(11), 1011–1018.
Samefink, W. H., & Rutherford, D. G. (2002). Most frequent contributors to hospitality literature. *Journal of Hospitality and Tourism Education, 14*(3), 23–29.

Sandstrom, P. E. (1994). An optimal foraging approach to information seeking and use. *The Library Quarterly, 64*(4), 414–449.
Sheldon, P. J. (1991). An authorship analysis of tourism research. *Annals of Tourism Research, 2*(May), 6–11.
Stokes, T. D., & Hartley, J. A. (1989). Coauthorship, social structure and influence within specialties. *Social Studies of Science, 19*(1), 101–125.
Tribe, J. (2010). Tribes, territories and networks in tourism academy. *Annals of Tourism Research, 37*(1), 7–33.
Tsai, W., & Ghoshal, S. (1998). Social capital and value creation: The role of intrafirm networks. *The Academy of Management Journal, 41*(4), 464–476.
Wasserman, S., & Faust, K. (Eds.). (1994). *Social network analysis: Methods and applications.* New York, NY: Cambridge University Press.
Wasserman, S., & Galaskiewicz, J. (Eds.). (1994). *Advances in social network analysis: Research in the social and behavioral sciences.* Thousand Oaks, CA: SAGE Publications, Inc.
Weaver, P. A., McCleary, K. W., & Farrar, A. (1990). Academic contribution to four major hospitality journals revisited. *Hospitality and Tourism Educator, 2*(3), 30–32.
Wenger, E. (1998). *Communities of practice. Learning, meaning, and identity.* Cambridge, UK: Cambridge University Press.
Woodruff, E. (1999). *Concerning the cohesive nature of CSCL communities.* Paper presented at the conference on computer support for collaborative learning. Palo Alto, California.
Xiao, H., & Smith, S. L. J. (2005). Source knowledge for tourism research. *Annals of Tourism Research, 32*(1), 272–275.
Xiao, H., & Smith, S. L. J. (2008). Knowledge impact an appraisal of tourism scholarship. *Annals of Tourism Research, 35*(1), 62–83.
Zuccala, A. (2006). Modeling the invisible college. *Journal of the American Society for Information Science and Technology, 57*(2), 152–168.

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