AN ANALYSIS OF LEADERSHIP NETWORKS IN MIS RESEARCH

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ABSTRACT

This study identifies academic leaders in MIS research through a social network analysis of the co-authorship networks in the domain. Articles in the three leading MIS journals, ISR, JMIS and MISQ, comprise the data set that is used in this study. Specifically, the networks of selected academic leaders are further explored by analyzing their sub-groups and the corresponding research areas.

Key words: MIS research, co-authorship networks, social network analysis

INTRODUCTION

There have been many discussions about the gaps between MIS research and the current state of practice. There have also been warnings about the decline of the discipline of MIS in this age of socialized information and rapid technological advances. But these issues are better understood by a deeper analysis of the academic work that has been accomplished by the researchers in this field. This paper provides the highlights of such an analysis by studying the network of leading academic researchers over the past twenty years, and focusing in on the works of key academic leaders and their co-authors.

DATA COLLECTION AND ANALYSIS

The commonly accepted leading journals in MIS research are Information Systems Research (ISR), Management Information System Quarterly (MISQ) and the Journal of Management Information Systems (JMIS). While other well established journals like Decision Sciences and Management Science also publish leading MIS research articles, they are primarily from other domains. All the co-authors of articles published in ISR, MISQ and JMIS over the past twenty years (1990-2009) formed the dataset for this study. All three journals had a total of 4120 author-article instances and 6178 author-author relationships over the twenty year period used in the study. This included 2006 authors associated with 1717 articles in all. Of these, ISR had 437 articles, MISQ had 576 articles, and JMIS had 704 articles. Data collection and cleaning is a significant effort. One of the key challenges is that authors have different versions of their names when publishing in different journals at different points in time. This has to be manually reconciled and the process is time consuming. The social network analysis tool ORA was used to help identify and analyze the author and article networks.

CENTRAL LEADER: JAY NUNAMAKER

The Total Degree Centrality of an individual author (node) in a network represents those who are "in the know". They are those who are linked to many others and so, by virtue of their position have access to the ideas, thoughts, and beliefs of many others. Individuals who are "in the know" are identified by degree centrality in the relevant social network. Those who are ranked high on this metrics have more connections to others in the same network. The scientific name of this measure is total degree centrality and it is calculated on the author by author matrices. For the Author x Author network with shared Articles (size: 2006 Authors, network density: 0.00253), the following are the top 10 Authors with the highest Total Degree Centrality (Table 1).

RANK Total Degree Centrality	**AUTHOR**
1	Nunamaker_Jay_F_Jr
2	Benbasat_Izak
3	Dennis_Alan_R
4	Whinston_Andrew_B
5	Agarwal_Ritu
6	Clemons_Eric_K
7	Grover_Varun
8	Kauffman_Robert_J
9	Briggs_Robert_O
10	Mukhopadhyay_Tridas

Table 1: Top 10 Authors in Total Degree Centrality

Clique Count is the number of distinct cliques to which each node (author) belongs. Individuals or organizations that are high in number of cliques are those that belong to a large number of distinct cliques. A clique is defined as a group of three or more actors that have many connections to each other and relatively fewer connections to those in other groups. The scientific name of this measure is clique count and it is calculated on the agent by agent (author x author) matrices. The Clique Count for the top 10 Authors is given below (Table 2).

RANK Clique Count	**AUTHOR**	**Clique Count**
1	Nunamaker_Jay_F_Jr	28
2	Whinston_Andrew_B	19
3	Dennis_Alan_R	17
4	Agarwal_Ritu	16
5	Grover_Varun	15
6	Zmud_Robert_W	13
7	Vogel_Douglas_R	13
8	Kauffman_Robert_J	12
9	Mukhopadhyay_Tridas	11
10	Straub_Detmar_W_Jr	10

Table 2: Top 10 Authors Clique Count

What we note above is that Nunamaker is the Author with highest Total degree Centrality and with the highest Clique Count. So we investigate his immediate co-author network further.

Figure 1 shows the Nunamaker co-author network classified using the Newman Modularity value which measures the degree to which the grouping has found community structure among the co-authors.

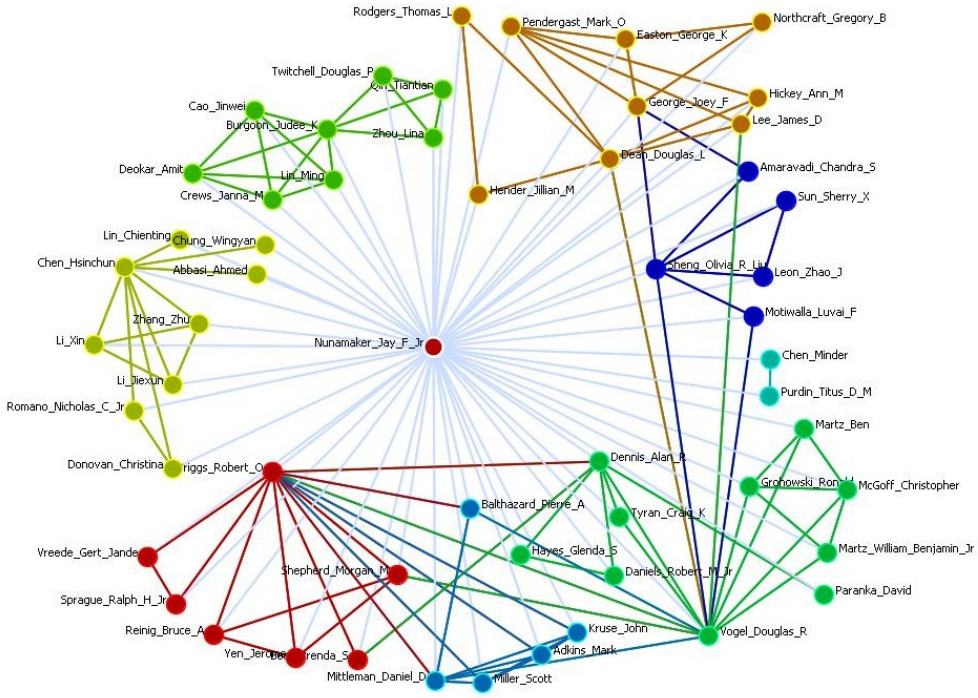

Figure 1: Nunamaker Immediate Co-Author Network

Table 3 below identifies the articles according to the Newman groups. Also, the corresponding research topics are also identified. This analysis begins to spread light on the clusters of research that Nunamaker published in the top IS journals over the past 20 years. By also reviewing the corresponding publishing periods for these topics, a clearer picture of his research emerges. Certain areas of research such as DSS and GDSS have effectively been closed. Current research efforts (See Group #5 in Table 3) appear to be concentrated on analytic approaches, specifically on unstructured qualitative data analysis as well as knowledge evolution using patent citation. This probably signals a shift away from a social-science driven research agenda that has dominated MIS research for almost two decades. Group #9 spans nearly two decades, and while having other co-authors, is dominated by Sprague and Briggs. They represent established relationships and this is reflected in the nature of the publications that are editorial in nature or a collection of different topics. These two groups are highlighted in the table below.

Newman Group Number	Article IDs	Research Topics	Publishing Period
1	JIMS199123	Decision Support Systems	1991
2	JMIS199128	systems development	1991
3	JMIS199021, JMIS199205, ISR200603	Electronic Meeting Systems, Integrated Office Information System, Knowledge-Based Approach to Integrated Office Systems, Data-Flow Perspective for Business Process Management	1990-2006
4	ISR199017, JMIS199008, JMIS199745, JMIS200219	Electronic Meeting Systems, Collaborative Software Engineering, idea generation with group support systems (GSS), group decision support system (GDSS)	1990-2002
5	JMIS199947, JMIS200317, JMIS200526, JMIS200821, JMIS200915	Kohonen Self-Organizing Map (SOM) algorithm for neural-network-based textual classification technique, Methodology for Analyzing Web-Based Qualitative Data, knowledge discovery on the Web, Stylometric Identification in Electronic Markets for Online reputation systems, machine learning framework for knowledge evolution processes with patent citations	1999-2009
6	JMIS199643, JMIS199840	Group support systems, Technology Transition Model and transition to GSS,	1996-1998
7	JMIS200419, JMIS200628	Predicting Deception in Computer-Mediated Communication, Multi-methodological cross-paradigm IS research approach	2004-2006
8	JMIS199020, MISQ199031, JMIS199107, JMIS199129, MISQ199229, JMIS199330, JMIS199720	Electronic meeting systems, IS to support competitive advantage, Automated Support in Business Process Re-Engineering, Group support systems for strategic planning,	1990-1997
9	JMIS199229, JMIS199574, JMIS119568, JMIS199746, JMIS199750, JMIS200045, JMIS200319, JMIS200702, JMIS200707, JMIS200820, JMISS200910	Pen-based interfaces, IT Organizational Impact, electronic brainstorming, GSS technology to support distributed collaboration, Measurement of Ideation Quality, Multiple guest editorials with Sprague and Briggs.	1992-2009

Table 3: Nunamaker Research Groups and Topics

BROKER LEADER: MUKHOPADHYAY TRIDAS

The Betweenness Centrality of node (author) network is defined as: across all node pairs that have a shortest path containing the node, the percentage that pass through that node. Individuals or organizations that are potentially influential are positioned to broker connections between groups and to bring to bear the influence of one group on another or serve as a gatekeeper between groups. This agent occurs on many of the shortest paths between other agents. The scientific name of this measure is betweenness centrality and it is calculated on agent by agent

(author x author) matrices. For the Author x Author network with shared Articles (size: 2006 Authors, network density: 0.00253), the following are the top 10 Authors with the highest Betweenness Centrality.

RANK Betweenness Centrality	Node Title
1	Mukhopadhyay_Tridas
2	Agarwal_Ritu
3	Zmud_Robert_W
4	Straub_Detmar_W_Jr
5	Whinston_Andrew_B
6	King_William_R
7	Kauffman_Robert_J
8	Benbasat_Izak
9	Davis_Gordon_B
10	Rai_Arun

Table 4: Top 10 Authors in Betweenness Centrality

What we note above is that Mukhopadhyay is the Author with highest Betweeness Centrality. So we investigate his immediate co-author network further. Figure 2 shows the Mukhopadhyay co-author network classified using the Newman Modularity value which measures the degree to which the grouping has found community structure among the co-authors. Interestingly, he is also among the top 10 authors for highest Total Degree Centrality as well as Clique Count, making him an influential leader who is also "in the know".

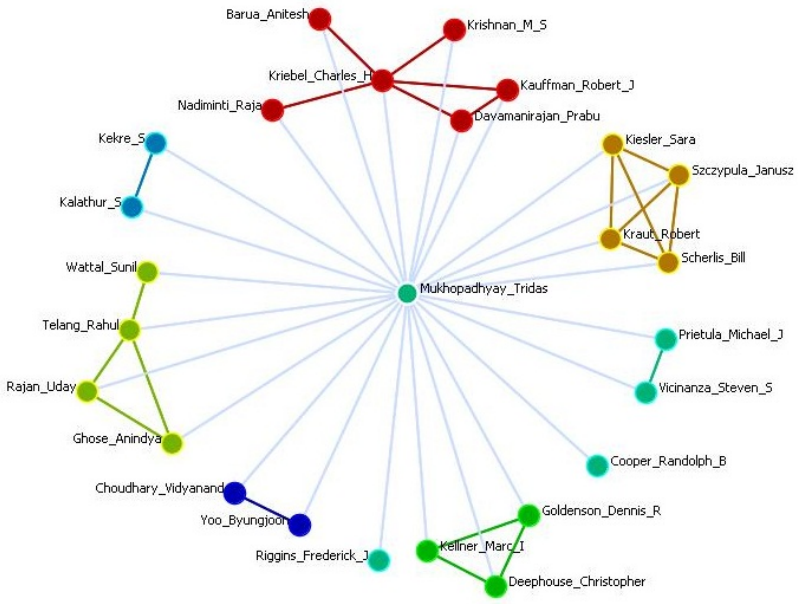

Figure 2: Mukhopadhyay Immediate Co-Author Network

Mukhopadhyay's research listed below also shows some areas of research as closed. But he appears to have developed Group #3 focusing in internet-based research and Group #7 that focuses on outcomes on IT application.

Newman Group Number	Article IDs	Research Topics	Publishing Period
1	JMIS199405	Inter-organizational systems (IOS)	1994
2	JMIS200228	Modeling Neutral B2B Intermediaries	2002
3	JMIS200407, ISR200720, JMIS200924	Market Structure for Internet Search Engines, Information Personalization in Product Differentiation, Impact of Internet Referral Services on a Supply Chain	2004-2009
4	MISQ199515	EDI and Business Value of IT	1995
5	JMIS199578	Software development project performance	1995
6	ISR199906	Information and Communication Uses of the Internet	1990
7	JMIS200609, ISR200401, ISR200205, MISQ199165, ISR199532	Systems Design, Process Performance, and Economic Outcomes of IT Systems, Information Technologies and Business Value, Intra-firm Resource Allocation, Stochastic decision model for the maintenance of information systems	1991-2006
8	ISR199111, MISQ199203, JMIS199310	Software-effort Estimation, Business Value of IT	1991-1993

Table 5: Mukhopadhyay Research Groups and Topics

EMERGENT LEADER: RITU AGARWAL

Agarwal is an emerging leader as shown by her strong ranking in the Total Degree Centrality (rank 5), Clique Count (rank 4) and Betweenness Centrality (rank 2) measures in previous tables.

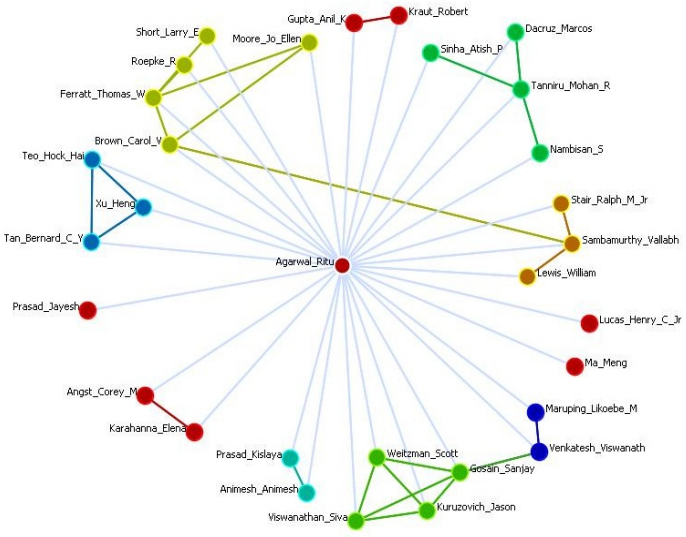

Figure 3: Agarwal Immediate Co-Author Network

So we investigate her immediate co-author network further. Figure 3 shows the Agarwal co-author network classified using the Newman Modularity value which measures the degree to which the grouping has found community structure among the co-authors. Interestingly, she is also among the top 10 authors for highest Total Degree Centrality as well as Clique Count, making her an influential leader who is also "in the know". Her work is centered around IS management as well as being end-user centric. This makes her work human-centric.

Newman Group Number	Article IDs	Research Topics	Publishing Period
1	JMIS199010	Knowledge Acquisition Using Structured Interviewing for Expert Systems	1990
2	JMIS200935	privacy concerns in the Location-based services (LBS) context	2009
3	MISQ200521	transformational impact of IT	2005
4	ISR199812	personal innovativeness in the domain of information technology	1998
5	ISR200704	IT artifacts effect on knowledge contribution in online communities	2007
6	ISR200920	understanding of the "digital divide"	2009
7	JMIS199209, JMIS199605, MISQ199912	Knowledge-Based Support for Combining Qualitative and Quantitative Judgments in IS Project Selection, Cognitive Fit in Requirements Modeling,	1992-1999
8	JMIS199323, MISQ200020, ISR200512	Measuring differences in management of IS professionals, IT human resource management (HRM) practices,	1993-2005
9	MISQ200006, MISQ200605, ISR200816, ISR200633, ISR200511, MISQ200922	ISR Editorial overviews with Gupta and Kraut on interplay between digital and social networks, technology acceptance, adoption of electronic health records	2000-2009
10	ISR200813	effect of online information sources (OISs) on consumer information search processes	2008
11	ISR200220, ISR200907	Web site usability, effective agile practices for improving software project quality	2002-2009
12	ISR200006, MISQ200213, MISQ200307	computer self-efficacy and technology use, individuals beliefs of technology use	2000-2003

Table 6: Agarwal Research Groups and Topics

DISCUSSION

Social network mapping and analysis helps make the academic leadership network a little more "visible". Studying an author's network is beyond simply identifying his/her co-authorship, but further explores the actual nature of their joint work. It clearly delineates the various research

teams that were created to address different subjects within the discipline, and the relationships between these teams. Since these author networks are developed over time, we can also identify some of the co-author sub-networks that are maintained over time while others represent "brief-encounters" of individual academic careers.

Nunamaker has the highest total degree centrality. He is an "in the know" leader. The sphere of influence map indicates the many distinct author groups connected to this leader. It must be noted that he is also linked to other central players like Sprague, who himself is in the top-ten authors with highest degree centrality. Nunamaker's research groups #5 and #9 show the type of work that is continuous over two decades that this study investigates. These cover both the technically focuses (#5) and broader conceptual (#9) issues. Further his research publications are concentrated in JMIS among these top there journals. Mukhopadhyay has the highest betweenness centrality. He is the "gatekeeper" leader. The sphere of influence map indicates that while he may not be connected to as many distinct authors, he is the bridge that connects different groups. His publications are mainly in JMIS and ISR, and primarily focus on the business value of IT. Agarwal appears to be one of the important emerging leaders from the network analysis. Her research is distributed across the all the three main journals ISR, MISQ and JMIS considered in this study, and is focused on the human element and addresses both the IS professional and user related issues.

This network analysis of the research of these three MIS academic leaders clearly shows their past and current directions as well as co-author groups. In addition, we clearly can see their focus being net-centric. While Nunamaker is analytic and knowledge focused and is *system-centric*, and Mukhopadhyay is B2B oriented and is *business-centric*, Agarwal appears to be more aligned with professionals, users, and the socialization of information and the technological revolution that is driving it, and is *human-centric*. These are not efforts each of them has begun recently as a response to emerging MIS practice, but have a long stream of work in the respective areas. Taken together, we see that these three key leaders continue to drive academic MIS and keep it, not just aligned with current state of MIS practice, but leading it in their respective areas.

As a result of this analysis of academic co-authorship networks in leading MIS literature, we find that the gaps between MIS academic research and practice are not as glaring as many claim it to be. MIS academic leaders have been addressing the *system, business and human-centric* nature of IS over many years. These core characteristics of the domain will not change despite the many technological advances we have experienced, and will no doubt continue to experience. We recognize the obvious limitations of our initial study in that not all leader networks have been evaluated, and all key journals in the domain have been analyzed. But this study demonstrates that we need to develop a deeper understanding of the distributed and networked knowledge that is characteristic of academic MIS research, before anyone writes its premature obituary.

REFERENCES

References will be provided upon request.