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# Using Social Networks and Communities of Practice to Support Information Systems Implementation

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# USING SOCIAL NETWORKS AND COMMUNITIES OF PRACTICE TO SUPPORT INFORMATION SYSTEMS IMPLEMENTATION

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## Abstract

*Information System (IS) implementations are a risky business with studies showing only a 16% - 29% success rate. This research explores the use of social network analysis (SNA) to inform the creation of a Community of Practice (CoP) to support a Finance Management System implementation in a higher education organization. IS implementations can be equated to the diffusion of innovation. The successful diffusion of an innovation requires it to be communicated through a social system. Organizations rarely know what their social network looks like – it is not the formal organization chart. SNA can be used to gain an understanding of the social network and how individuals with high social capital can be identified. There is growing evidence that CoP support successful organizational change initiatives but it is less clear how CoP membership might be agreed. SNA provides an evidence-based approach to CoP formation. The IS implementation case described in the paper demonstrates a new approach to IS implementation grounded in social capital and CoP and illustrates how it might be conducted in practice.*

*Keywords: Communities of Practice, Social Network Analysis, Social Capital, Centrality.*

# **1 INTRODUCTION**

The purchase, implementation, and maintenance of information technology is a significant element of cost for organizations. In the higher education sector, the 2006 Campus Computing Survey found that IT expenditures averaged between 4.6 and 8.2 percent of college and university budgets (Green 2006). In the 1990's, United States higher education institutions spent an estimated five billion dollars on enterprise administrative systems alone (Goldstein and Katz 2005). Unfortunately, not all information technology projects are successful. The 2004 Chaos Report (Standish Group 2004) reports that: 29% of projects succeeded (delivered on time, on budget, with required features and functions); 53% are challenged (late, over budget and/or with less than the required features and functions); and 18% have failed (cancelled prior to completion or delivered and never used).

Following Rogers (2003), the implementation of a new IT system can be seen as an innovation, which he defines as "an idea, practice, or object that is perceived as new by an individual or other unit of adoption" (p.475). The diffusion of an innovation is concerned with its spread over time and space, i.e., "the process in which an innovation is communicated through certain channels over time among the members of a social system" (Rogers 2003, p.474). One way to successfully diffuse innovation, such as the implementation of a new technology, is to ensure communication channels are optimized and opinion leaders support the project. Individuals with social capital utilize their power to influence other's opinions, attitudes or actions as well as control communication flow. Social Network Analysis (SNA) employs established measures to identify individuals in an organization's informal social network who possess a high degree of social capital.

The current research reports on the innovation of a new finance IT system that needs to be diffused across a community of finance users in a higher education organization (HEO). The approach explored in this paper is to identify individuals with social capital and invite them to participate in a community of practice, an intra-organizational entity that can leverage the power, prestige and social influence of its members to support the implementation of a new technology in the wider informal social network of the organization.

## **2 BACKGROUND**

### **2.1 Social capital and social networks**

The definitions of social capital are many and varied. This research uses Lin's (2001) definition of social capital as "investments in social relations with expected returns in the marketplace". Social capital is concerned with a person's relationships, the resources tied up in those connections, and the ability of the individual to secure value or benefits from those relationships (Borgatti and Foster 2003; Kilduff and Tsai 2003; Portes 1998). Those individuals with high social capital would be expected to be key opinion leaders by virtue of their power, prestige and social influence in the organization. They should, therefore, be well placed to support an innovation, such as a new IT system, and its diffusion through a social network.

### **2.2 Social network analysis**

Social Network Analysis (SNA) is a recognized and established approach for describing organizations and measuring the effects of organization systems (Zack 2000). Organizations have used SNA to improve their strategic decisions, promote innovation, and develop communities of practice (Wasserman and Faust 1995; Haythornthwaite 1996; Cross and Parker 2004). By targeting strategic points in an organization's social network, managers can ensure information is disseminated quicker, collaboration occurs among the right individuals, and strategic expertise is leveraged when and where it is needed. Cross and Parker (2004) assert, after looking at sixty-two organizations, that well-managed networks are integral to performance, learning, and innovation.

SNA provides an organization the tools to identify who is strategic or central in the organization, who has advantages in the social network, which relationships are critical for obtaining information and solving problems, and who has influence over others in the adoption of innovations (Burt 1987; Cross et al. 2001). Individuals who are central in an organization are often those that have the most power and influence within their social network (Brass and Burkhardt 1992). This power, prestige, and social influence can also be labeled as social capital (Burt 1992).

Social network centrality is illustrated in figure 1. In this diagram, Joy is the central figure in her social network. She is positioned at the hub of a wheel or at the centre point of the star (Freeman 1978). To be central in an organization is to be located in a position with the most connections and relationships. This central position can be defined as having three properties: (1) the maximum possible *degree*, or connections to others, (2) located on the geodesics (shortest paths) *between* the largest possible number of other points, and (3) the minimum distance from all other points or the *closest* to them (Freeman 1978).

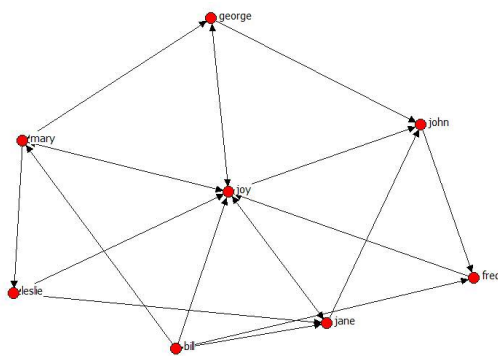


Figure 1 – Social network diagram

These three social network measures, degree, betweenness, and closeness, are commonly accepted as the standard measures of centrality. The first two centrality measures identify the prestige of individuals in the number of connections to others in degree centrality and the potential for control of information in an individual's location between other actors in flow betweenness. The third centrality measure, closeness, identifies the efficiency of communication exchange by an individual based on how close she is to other people in her social network (Costenbader and Valente 2003; Wasserman and Faust 1995).

Central individuals either use their social capital to support the organization or inhibit it. Unsung heroes, as labelled by Cross & Parker (2004), share information across groups, engage in problem solving, and actively collaborate with others to get work done. They could potentially assist new technology implementations by sharing information, encouraging others, and collaborating across groups in problem solving to develop creative ways to use the new technology application. Bottlenecks, on the other hand, are those central individuals who end up holding the group back and negatively impact the production of the organization (Cross and Parker 2004). They do this either because they are too busy and do not have time to share information and collaborate with others, or because they use information as a means of power or control over others. Bottlenecks could potentially hinder a technology implementation by blocking the dissemination of important information, not teaching others how to use the technology, or even by actively hoarding information on the benefits and usefulness of the new technology.

Organizations would benefit from research in how to identify and leverage their unsung hero's in support of a technology implementation. Social science researchers have a long history of measuring and identifying centrality in social networks. IS researchers have also started to incorporate SNA in their work. A literature review of the top fifteen MIS journals as ranked by the Association for Information Systems found that IS researchers were incorporating aspects of social networks when looking at knowledge management, performance, changes to organizational structures, and in IS

research self reflection (ISWorld.net Journal Rankings 2008). No research was found that utilized SNA to identify individuals with social capital to support a new technology implementation.

### **2.3 Communities of Practice**

The term, Communities of Practice (CoP), is attributed to Wenger and defined as “a group of people who share a concern, a set of problems or a passion about a topic and who deepen their knowledge and expertise in this area by interacting on an ongoing basis” (Wenger et al. 2002; Cross et al. 2006). CoP’s are informal, self-selecting, self-organizing, and organic. They often form when a group of individuals who share a common passion or expertise come together (Wenger et al. 2002; Wenger and Snyder 2000).

CoP are different from a project team that is formed for a specific purpose with defined objectives and reporting structures (Lesser and Prusak 1999). Project teams are routinely used by organizations to support technology implementations. They are good at focusing on specific tasks and solving their own problems (Wenger et al. 2002). Project teams function at a workgroup level to solve specific problems or set standard procedures for particular work processes.

CoP, on the other hand, can generate and share knowledge on an enterprise level (Wenger et al. 2002). CoP collaborate, learn and support each other resulting in knowledge creation that can be used to produce best practices, creatively solve problems, and effectively communicate standards and procedures (Wenger and Snyder 2000; Zboralski et al. 2006). All of these elements are needed for a successful technology implementation. As organizations look for ways to successfully manage enterprise-wide software implementations, CoP may provide a means to improving information sharing, problem solving, and innovation (Cox 2005; Wenger et al. 2002).

The original definition of CoP was that they were informal, self-organizing and resistant to managerial interventions. Although organizations cannot mandate CoP, they can bring the right people together, nurture them, and create an environment where CoP thrive (Lesser and Prusak 1999; Wenger and Snyder 2000). CoP have been used in well-known organizations such as Hewlett Packard, IBM, and BP to improve performance and promote innovation (Cross et al. 2006). By understanding what knowledge is needed to gain a strategic advantage in the marketplace, or to successfully implement a new technology, an organization can encourage appropriate individuals to form a CoP as well as set outcome expectations and measure success (Wenger et al. 2002).

In summary, identifying the right people is a challenge faced by organizations who wish to create a CoP (Wenger and Snyder 2000). If the organization is implementing a new technology, they would need to identify individuals who would be able to influence others, diffuse innovation, and communicate effectively throughout the organization. Social network analysis can be utilized to identify individuals in an organization with the social capital necessary to meet those objectives. An organization can then leverage the power and prestige of those individual’s by nurturing a CoP that supports the new technology implementation.

## **3 RESEARCH CONTEXT AND RESEARCH DESIGN**

### **3.1 The higher education context**

One business segment with a vested interest in technology implementations is higher education. Historically, higher education organizations (HEOs) did not worry about the marketplace; they went about the business of teaching and learning without great concern for revenue, expenses, marketing, or the bottom line (Bok 2003). However, the end of the 20<sup>th</sup> century resulted in a new world for HEOs. Increased competition, pressure to control costs and reduce increases in tuition, increased consumer power and choice, and greater pressure to define and assess outcomes are now characteristics of the higher education sector (Goldstein and Katz 2005). New players such as for-profit universities, corporate training centres, and online education give students additional choices other than a

traditional residential campus. Reductions in government funding have resulted in changes to traditional financial aid and tuition structures.

To be successful in this new and competitive marketplace, higher education organizations have had to do things differently (Rowley 2000). One way colleges and universities have responded to these pressures and challenges is to implement new information technologies. Technology solutions are being used in all areas of the university from marketing to prospective students on the web, managing financial data, providing online academic resources, assisting in faculty and student research, to connecting with alumni (Foster and Hollowell 1999). Technology solutions are often looked at as a silver bullet for improving market share, providing better customer service, and reducing costs (Kvavik et al. 2005).

### **3.2 The case**

A good case to look at technology implementations from a social network perspective would be a university starting an enterprise-wide IS implementation involving individuals crossing physical, departmental, and hierarchical boundaries (Cross and Parker 2004). This case was conducted with a HEO of almost 12,000 students, which was implementing an enterprise-wide finance system. The implementation, which we shall call FMS - finance management system - was a multi-million dollar project of strategic importance to the university and required employee participation from across the organization. The FMS project involved a considerable organizational change element as finance processes were to be reviewed and redesigned to afford greater visibility of costs and management of the business processes (e.g., checking against budget before issuing a purchase order and increased use of preferred vendors). The change involved staff working in management, accounting, general ledger, research, accounts payable, and purchasing.

### **3.3 Research methodology and research design**

A number of different types of action research (AR) exist, each characterized by different process models, structures, and goals (Baskerville and Wood-Harper 1998; Davison et al. 2004). Regardless, the defining feature of all action research is intervention into, and change in, a practical problem situation for the purpose of 1) solving the particular problem (problem solving cycle) and 2) contributing to the research literature with new knowledge (research cycle). Collaborative practice research (Mathiassen 2002) aims to fulfil this dual imperative (McKay and Marshall 2001) through the understanding, support, and improvement of IS development in practice. The AR project presented in this paper was conducted as collaborative practice research. The problem solving cycle was performed as an iterative process where we continuously sought to: understand the HEO's situation (diagnosis and reflection); identify ways to support the content and process of change (planning); and intervene in the situation in order to improve it (action).

The research project consisted of three phases. First, a social network analysis was conducted to identify individuals having a high level of social capital and strong, well-connected positions in the social network. Second, the individuals identified in the social network analysis were invited to form a Community of Practice (COP) to support the enterprise-wide implementation of the finance system. The leadership team hoped that the CoP would facilitate information sharing and knowledge generation. Third, the effectiveness of the CoP was evaluated to gauge its contribution to the implementation of the IT system. The research is primarily qualitative in nature, although quantitative techniques were used to analyze the social network data.

## 4 FINDINGS

### 4.1 Social Network Analysis (SNA)

A survey was created that assessed an individual's social network. Based on an overview of SNA literature, four questions from Cross and Parker (2004) were selected that also incorporated questions used by Tenkasi & Chesmore (2003) and Ibarra & Andrews (1993) in their research. The survey was administered to each staff member across the university who would receive training on the new finance management system (FMS). A list of the individuals in the finance social network was used in an attempt to make the questions easier to answer and to lessen the chance that respondents would forget some of their relationships (Stork and Richards 1992).

Table 1 lists the two key social network questions used to analyze the FMS social network in this research. The bold headers indicate what each question was designed to measure.

<b>Q1. Communication:</b> How often do you communicate with this person regarding work and what is going on at the University?		
1 = Never	4 = Monthly	7 = Daily
2 = Annually	5 = Every two weeks	
3 = Quarterly	6 = Weekly	
<b>Q2. Innovation:</b> How often are you likely to turn to this person in order to discuss a new or innovative idea or business process?		
1 = Never	4 = Monthly	7 = Daily
2 = Annually	5 = Every two weeks	
3 = Quarterly	6 = Weekly	

*Table 1. Social Network Analysis Questions*

The survey was distributed to the 156 staff involved in FMS project. The response rate was 56%. Although this is a good response rate for a survey, missing key individuals in social network analysis can impact the overall understanding of the social network being studied (Cross and Parker 2004; Borgatti et al. 2006; Costenbader and Valente 2003). Social network analysis measures relationships and relationships, by their very nature, do not belong to a single individual. Therefore, it is important to get information from all parties involved in the relationship in order to analyze it correctly (Stork and Richards 1992). It is unrealistic, however, to expect a 100% return rate from any survey (Robins et al. 2004). Historically, network researchers have had to analyze data sets with response rates between 90% and 65% (Stork and Richards 1992). Since this is a qualitative study, the results were used to inform the case rather than to be interpreted for statistical significance. The social network data was analyzed using a combination of UCINET and NetDraw software (Borgatti et al. 2002). Table 2 outlines the specific methods used in UCINET to calculate centrality.

### 4.2 Community of Practice

The organization understood that knowledge is a critical asset and must be managed strategically and that CoP might be one way to strategically manage a technology implementation to enable learning, share knowledge, create connections across the organization, and improve the implementation (Zboralski et al. 2006; Cox 2005). The organization sought to identify individuals who are central to the organization, possess a high degree of social capital, and therefore have the potential to influence others opinions to accept a new technology.

Social network analysis using all three centrality measures was performed on each of the survey questions. In-degree was a key measure in that it has been shown to be reliable for low sampling rates, having higher correlations between the actual and the sampled network measures (Costenbader and Valente 2003). In practice, in-degree also identifies individual's who are key in the communication

network of an organization and who others perceive as prestigious, trustworthy and popular (Wasserman and Faust 1995).

<b>Method</b>	<b>Definition</b>	<b>What it measures</b>
<u>In-degree</u>	The number of incoming ties directed at an individual (Costenbader and Valente 2003, Brass and Burkhardt 1992).	Communication activity and prestige
<u>Betweenness</u>	The extent an individual lies “between” others on the network (Hanneman and Riddle, 2005, Freeman, 1978). Specifically, this research used flow betweenness as a means to measure actors shortest “geodesic” path between all other actors (Hanneman and Riddle 2005).	Control of communication and leadership
<u>Closeness</u>	The extent an individual lies at short distances to all other people in the network or how “close” a person is to others (Hanneman and Riddle 2005, Cross and Parker 2004). It is calculated by adding together the lengths of the shortest paths from one individual to all other individuals (Brass and Burkhardt 1992).	Individual’s independence and efficiency

*Table 2. Social Network Analysis Centrality Measures*

These individual’s possess a certain degree of social capital and their centrality measures identify them as good candidates to facilitate the diffusion of innovations. The in-degree measures were analyzed and a list of the most central people was presented to the project’s leadership. The HEO management took into account each individual’s social capital, department and function in the organization, and personality to create a CoP user group to support the implementation. The hope was that these individuals would leverage their social capital collectively to communicate, motivate and innovate.

Table 3 lists the in-degree measures for question 1 by department for the members of the CoP illustrating that CoP membership was distributed across the organization. In-degree scores ranged from the highest in-degree being 261 to the lowest in-degree measure of 3. Figure 2 is a social network diagram illustrating the in-degree measures of the social network for question 1, Communication. The larger node size represents more incoming ties and the small node’s represent individuals with fewer incoming ties. The diamonds represent members of the CoP.

<b>Dept 1</b>	<b>Dept 2</b>	<b>Dept 3</b>	<b>Dept 4</b>
150	217	106	165
100	161		
93			
77			

*Table 3. Question 1 In-degree Measures by Department for Members of the CoP*

Two months following the FMS implementation, semi-structured interviews were conducted with two project leads and three members of the CoP. The purpose of the interviews was to gather follow-up information on how the university used the results of the social network analysis to support the implementation. The following questions were asked to each interviewee. Follow-up questions were asked as appropriate to gain further insight.

- What role did the CoP play in the implementation of the software (Zboralski et al. 2006; Wenger 2007a)?
- Did the CoP have defined goals and objectives for the project (Wenger 2007a)?
- What has been the most successful aspect of the implementation to date and how did the CoP impact that success?
- What could have been done differently to make the implementation even more successful and what could the CoP have done to assist in the implementation?
- What do you see as the future role of the CoP?



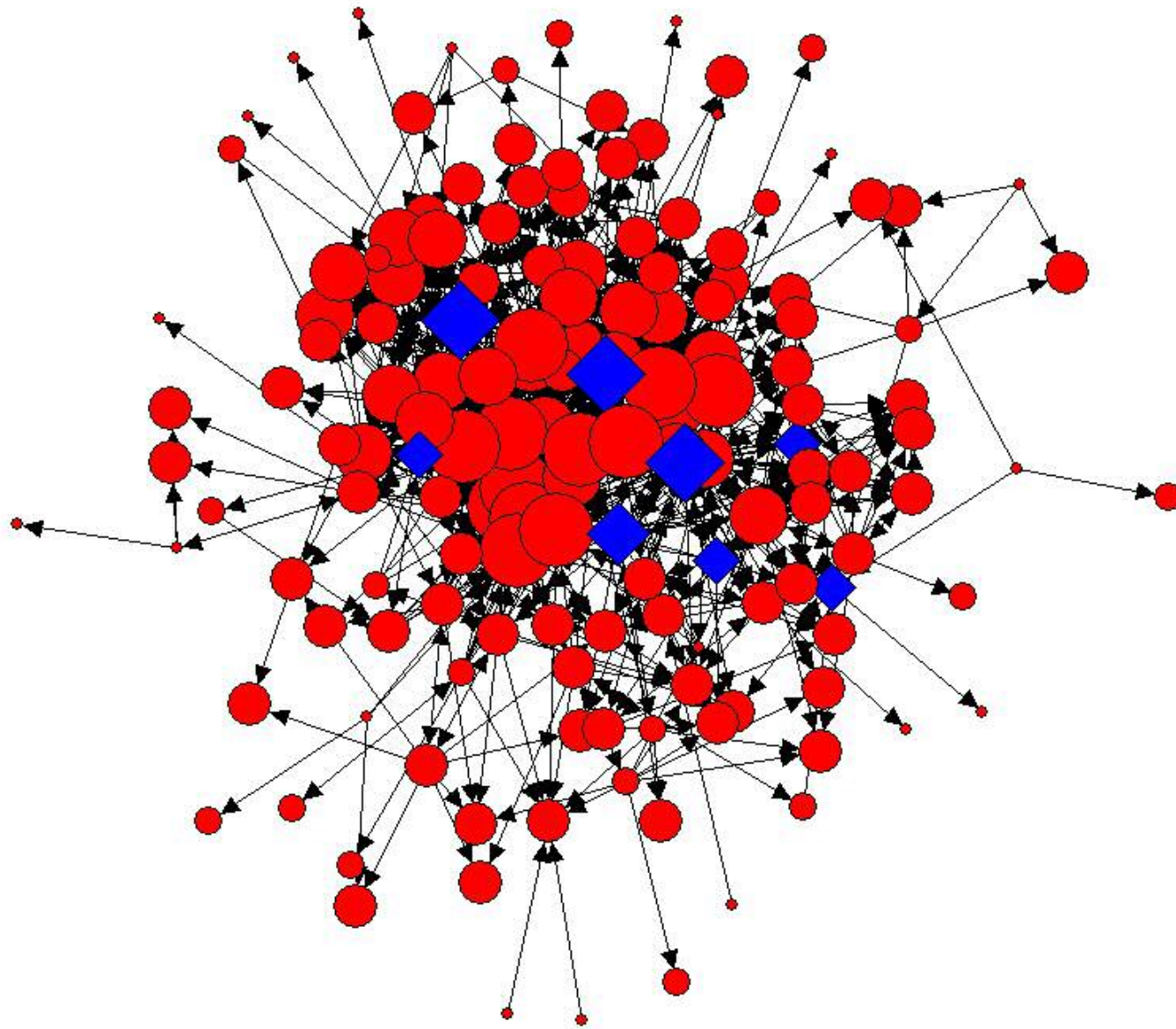


Figure 2 – In-degree centrality

The interviews suggested that the CoP served a valuable purpose as part of the implementation and met the expectations of a CoP in three main ways: as a sounding board, a place for sharing ideas, and a means of providing efficiencies in the implementation process (Wenger et al. 2002). First, the CoP served as a sounding board for the project management team. They helped raise the profile of the implementation among the user community prior to go live and provided guidance as to what and where to communicate information. One interviewee stated, “The CoP was a “valuable basis of dissemination of information. Those people are still the hubs of queries, the focal point for a number of people to clarify information.”

Second, the CoP served as a place to identify issues, share ideas, and provide support. As one interviewee stated about one member of the group, “She’d been saying, I’ve done this, it works for me, and I’ll come along and I’ll show you how to do it. So that people within the group are starting to share their experiences and then sharing those experiences out within that sort of web of contacts that they have got.” Learning that one person’s problems were not unique and others were having them as well, provided CoP members valuable support.

Third, the interviewees felt that CoP helped to make the implementation more efficient. As one interviewee stated, “if they were not there, the implementation team would have done some things that would not have worked.” By getting the CoP’s ideas (on training, communication, post-implementation), the implementation team avoided going off on tangents that would have diverted the project. Overall, the consensus was that the CoP was a big part of the success of the FMS implementation.

The CoP could have been even more successful if it had developed a stronger sense of role identity and had been facilitated by a strong leader (Wenger et al. 2002). The lack of goals and objectives may have contributed to interviewee perceptions that the meetings tended to drift and get bogged down with individual’s personal issues. Also, the CoP was good at getting information and issues to the project implementation team, but there seemed to be inconsistencies in disseminating information out to constituents. One member utilized an e-mail group to share relevant information with his constituents. Another member did not share information, but would have if he would have been asked. Lastly, many meetings of the CoP were attended by only two to three members. Causes of irregular attendance seemed to result from some members’ perception of relevance to their role at the institution, workload, and value. At least one member did not understand his purpose in the group. These issues may have been resolved through clarity of terms of reference and a stronger sense of group identity.

### **4.3 Outcomes**

The FMS went live and the CoP has been retained and institutionalized as the liaison group between the finance user population and the finance systems steering group. The CoP is responsible for identifying suggestions for change to the steering group and for communicating developments back to the user community.

## **5 DISCUSSION**

This case study provides insight into how one organization successfully utilized social network analysis to support a technology implementation, and more generally how SNA could be used to form a CoP to support any type of innovation or change process. As evidenced by the interviews, the social network measures seemed to identify the right people to participate in the CoP. One interviewee, when asked about the membership, stated, “it appeared to be a reasonable cross section and certainly people that knew people and people that were referenced by other members of staff, so it seemed to be a good mix and the right set of people ....”

The CoP added value to the FMS implementation process by facilitating communication between users and the project team, helping set priorities, and assisting with FMS user testing. One member of the project leadership team stated, "If that hadn't been there, we would have gone off on tangents that would have diverted us and we would not have had such a successful implementation." Another project leader stated that the CoP kept the implementation on track when she stated, "I think it (*the CoP*) helped us to focus more on what the users were thinking from within the project, I feel there were times that we were focusing on what was important to us and not necessarily thinking enough on what was important to users out there because we had been using the system for so long, we forgot about some of the very basic things that users need to know about and we saw them just as bread and butter things that we knew all about and they had never seen."

Although, the CoP could have added more value to the FMS implementation if it had a stronger sense of role identity, more resources, and a higher profile in the organization, the CoP was a step in the right direction. The CoP has been institutionalized following the implementation which is a good sign that it is perceived to have been useful to the implementation.

This case study contributes to Information System research by outlining a new approach to information technology implementation based on the identification of individuals with social capital and leveraging the associated power and prestige through a CoP. This novel approach can fairly easily be put into practice as evidenced by this case.

As with any research, this case study is not without limitations. The social network analysis aspect of the research has several limitations. First, when completing the social network questionnaire, people tend to forget important relationships or misreport interactions when completing a survey (Cross and Parker 2004). This questionnaire listed all the individual's names in the sample, which hopefully reduced the impact of this limitation. Secondly, the researchers are not experts in SNA which limits their ability to effectively select a population, deliver the survey, and interpret the results. Using a bounded sample and established questions helped minimize this limitation. Lastly, the small sample size had the potential to provide inaccurate results (Stork and Richards 1992). This case used the social network measures to inform the process and understood the statistical limitations.

The sensitivity of social network data can make data collection, analysis and reporting difficult. Individuals may not feel comfortable sharing information on their communication activities for political reasons and therefore, not complete the questionnaire accurately. Analyzing and reporting the results while keeping the identity of individuals confidential is also difficult when presenting network diagrams to project leadership. Also, organizations may not have expertise to analyze and interpret social network data accurately making this methodology potentially difficult to implement.

Limitations also existed when evaluating the usefulness of the CoP. First, it is not easy to identify the cause and effect terms of the usefulness of the CoP. Second, people who were not members of the CoP were not interviewed, although the HEO did conduct a post implementation review (PIR) that included a survey of the full user community to assess satisfaction with the FMS. The survey highlighted dissatisfaction with the consultation and communication aspects of the implementation process. It is unlikely that a management-driven initiative, such as the creation of a CoP, will, by itself, constitute a sufficient response to the organizational change issues that are associated with transformative IS implementations. Lastly, the research was done within three months of the implementation, leaving little time for users to become comfortable with the new technology and the changes to working procedures. This may have contributed to some of the negative feedback in the PIR user satisfaction survey (the HEO plans to conduct further user satisfaction surveys in the future).

Further research and more cases are needed to explore the usefulness and limitations of CoPs in IS implementation. For example, to what extent can a top-down management intervention lead to the formation of an effective CoPs, given that CoPs need bottom-up and self-organizing behaviours? Within this larger concern we also need to critically assess the usefulness of SNA in identifying appropriate members of CoPs and as a means of assessing their social capital.

## 6 SUMMARY

The successful diffusion of an innovation requires it to be communicated through a social system. Organizations rarely know what their social network looks like - and it may bear little resemblance to the formal organization chart. Although there is growing evidence that communities of practice (CoPs) support successful organizational change initiatives it is less clear how CoP membership might be agreed or how management might nurture the development of a successful CoP. The IS implementation case described in the paper demonstrates a social capital/CoP approach to IS implementation. The method involves using social network analysis (SNA) to gain a better (and evidence-based) understanding of the structure of an organization's social network; the use of SNA techniques to identify individuals in that network with high social capital; and the encouragement and support of those individuals in the formation of a community of practice (CoP) to support a transformative IS implementation.

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