
## DOCTOR OF BUSINESS (DBA)

# Exploring the use of social capital to support technology adoption and implementation

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# Exploring the use of social capital to support technology adoption and 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 capital to support technology implementations. This research brings together two distinct bodies of knowledge: social network analysis (SNA) and technology acceptance models, in order to better understand the relationship between social capital and technology acceptance. The first aspect of the research looks at social network centrality and influence measures as an alternative means to measure social influence in the Unified Theory of Acceptance and Use of Technology (UTAUT) model. The social influence construct has proven to be inconsistent in past research. An individual's decision to adopt a new technology is influenced by their social context or the informal social network within which they work. The social capital of others influences their attitudes and decision to adopt a new technology. Social Capital, as measured through social network analysis, could be substituted for the social influence construct of the UTAUT model. Two revised UTAUT models are developed and tested. The second aspect of this research uses social capital to inform membership of a Community of Practice (CoP) to support a Finance Management System implementation in a higher education organization. SNA can be used to gain an understanding of the social network and identify individuals with high social capital. There is growing evidence that CoP support successful organizational change initiatives but it is less clear how CoP membership might be determined. SNA provides an evidence-based approach to CoP formation. The IS implementation cases described in the paper demonstrate an innovative approach to IS implementation grounded in social capital and technology acceptance research that add to the body of knowledge in both theory and practice.*

# Abbreviations

| | |
|---|---|
| A | Attitude |
| AN | Anxiety |
| AR | Action Research |
| AT | Attitude |
| BI | Behavioral Intention |
| CoP | Communities of Practice |
| EE | Effort Expectancy |
| ERP | Enterprise Resource Planning |
| FC | Facilitating Conditions |
| FMS | Finance Management System |
| ICT | Information Communication Technologies |
| IS | Information System |
| IT | Information Technology |
| PE | Performance Expectancy |
| PEU | Perceived Ease of Use |
| PU | Perceived Usefulness |
| SE | Self Efficacy |
| SEM | Structural Equation Modeling |
| SI | Social Influence |
| SN | Subjective Norm |
| SNA | Social Network Analysis |
| TPB | Theory of Planned Behavior |
| TRA | Theory of Reasoned Action |
| UTAUT | Unified Theory of Acceptance and Use of Technology |
| VU | Voluntariness of Use |
| WWW | World Wide Web |

# 1. Introduction

Higher education institutions, like most other types of organizations, exist in a competitive, fast-paced, market-driven environment. Higher education institutions are recognized as being in the knowledge business and increasingly they are exposed to marketplace pressures in a similar way as other businesses (Steyn, 2004, Rowley, 2000). Historically, the traditional academy did not worry about the marketplace. Higher education went about its business of teaching and learning without a thought about revenue, expenses, marketing, or the bottom line (Bok, 2003).

The end of the 20th century resulted in a new marketplace for higher education. 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 higher education (Goldstein and Katz, 2005). New players such as for-profit universities, corporate training centers, and online education provide students alternative choices other than the traditional residential campus resulting in new competition for colleges and universities.

To be successful in this new marketplace, higher education organizations have had to do things differently. They have had to find a balance between academia and business, between mission and the market. They have had to become marketers, business analysts, and entrepreneurs. One way colleges and universities have responded to these pressures and challenges is to look at information technology solutions to support and attain their strategic initiatives.

Technology solutions are being used in all areas of the university from marketing to prospective students on the web, to managing financial data, to providing online academic resources, to assisting in faculty and student research, to connecting with alumni (Foster and Hollowell, 1999). Information Technology (IT) is used at all levels of the organization for communicating, decision making, and strategic planning. Technology solutions are often looked at as the silver bullet for improving employee productivity, providing better customer service, reducing costs, and ensuring faculty, staff and students accomplish their goals (Kvavik et al., 2005).

This silver bullet comes at a high cost. The purchase, implementation, and maintenance of information technology is a significant percentage of higher education's operating expenses. In the United States 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). Another study found that in the 1990's, United States higher education institutions spent an estimated five billion dollars on enterprise administrative systems alone (Goldstein and Katz, 2005). These costs combined with the need to be ever more competitive in the new higher education marketplace, means that the success of enterprise-wide technology implementations is crucial for an organization's success.

Unfortunately, not all information technology projects are successful. The 2004 Chaos Report indicated that: 29% of projects succeeded (delivered on time, on budget, with required features and functions); 53% were 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) (Standish Group, 2004). A 2002 survey conducted by Robbins-Gioia on 232 organizations found that 51% of those that had or were in the process of implementing an enterprise resource planning system felt that the implementation was unsuccessful. In addition, 46% felt that their organization did not understand how to use the Enterprise Resource Planning (ERP) system to meet their strategic objectives (BusinessWire, 2002).

This data illustrates that organizational investment in information technologies to support planning, decision making, and communication processes are inherently risky (Schwarz and Chin, 2007). The costs are high and the success rate is relatively low. Since the seventies, researchers have worked to gain a better understanding of technology adoption rates and implementation success in order to make the most of technology investments and turn these statistics around. Technology acceptance models are one way researchers assess an individual's intent to use a new technology and by extension predict usage and acceptance. These models continue to evolve in an effort to better predict adoption and improve implementation success rates. This research utilizes the Unified Theory of Acceptance and Use of Technology (UTAUT) model, which is considered to be parsimonious and more

accurate than other models in the prediction of behavioral intention to use a new technology (Venkatesh et al., 2003).

Technology acceptance instruments, including the UTAUT model, identify strong and weak elements within the organization that theoretically predict adoption and ultimately use of a new technology (Davis et al., 1989). Results from the surveys can be used by project managers to support and improve the technology implementation, hopefully improving their chances for success. For instance, if the data results in a low score for "ease of use", the project manager can provide additional training and support to assist functional users in the use of the new technology.

One of the elements common in most technology acceptance models is subjective norm or social influence. This element looks at the influence that important individuals in the organization have over the opinions and attitudes of others. Existing research consistently recognizes that an organization's informal social networks play an important role in determining an individual's intent to use a new technology (Murphy and Chang, 2002). However, one weakness of technology acceptance models, in general, and the UTAUT model, specifically, is understanding the social influence others in an organization have on an individual's intent to adopt a new technology. Research has also found that modeling the relationship between social influence and technology acceptance is complex and inconsistent (Lee et al., 2006).

Social influence can be looked at as the power an individual has over others in the workplace. Social scientists utilize Social Network Analysis (SNA) to look at an organization's informal social network. SNA measures relationships and maps out communication and interaction patterns in a particular social network. SNA is often employed to identify individuals who are central in their organization, those having power and influence over others (Brass and Burkhardt, 1992). This power, prestige, and social influence can be defined as social capital (Burt, 1992). An individual with high social capital may influence others in the organization to accept or reject the use of a new technology.

Therefore, it would be beneficial for an organization to understand who in their organization is central and possesses high social capital. Understanding an organization's social network may help strengthen the UTAUT model's Social Influence (SI) construct which is considered to be one of the weaker constructs. Researchers have used SNA to study the impacts of new technology on organizations (Murphy and Chang, 2002, Zack and McKenney, 1995). No literature, however, was found that used social network analysis to better understand the social influence construct of technology acceptance models nor modeled the relationship between social capital and technology acceptance.

The use of SNA to identify individuals with high social capital in an organization may be used in additional ways to support technology adoption and implementation. Social capital and SNA centrality measures could be used to inform the membership of a Community of Practice (CoP) whose purpose would be to promote the adoption and use of a new technology. The purpose of this research is to explore the use of social network analysis to identify individuals with social capital and use that knowledge to support technology acceptance of an enterprise-wide technology implementation. This research brings together two distinct bodies of knowledge, social network analysis and technology acceptance models, in order to better understand the relationship between social capital and technology acceptance as well as identify ways to use social capital to support technology implementations.

The research strategy incorporates mixed methods that meet the unique needs of different aspects of the study. One aspect of the research looks at the use of social network analysis to predict social influence in the UTAUT model rather than rely solely on the existing individual perceptions that make up the social influence construct. A survey instrument was created that incorporates both established UTAUT questions as well as social network questions focusing on communication, problem solving, and innovation. The second aspect of the research creates a CoP made up of individuals with social capital to support a technology implementation.

The research questions are:

Proposition 1: Is social capital, as identified through SNA, a stronger predictor of Behavioral Intention than the Social Influence construct of the UTAUT model?

H1: Social capital, as measured by SNA, will correlate with Behavioral Intention (BI/UTAUT). The higher an individual's social capital in an organization, the greater their intent to use the new technology.

H2: The Behavioral Intention (BI/UTAUT) of important others, others who are close to an individual in his social network, will influence his Behavioral Intention to use a new technology. The higher the BI scores of those close to an individual, the higher that individual's BI.

Proposition 2: How can a Community of Practice comprised of individuals with high social capital be enrolled to support a technology implementation?

This research was conducted on professional staff in three higher education organizations. The names of the universities have been changed for confidentiality reasons. The first sample is from Alpha University, a top-ranked research university of almost 12,000 students located in the United Kingdom and their finance management system implementation. The second sample is from Saints College, a private, liberal arts college of about 3000 students located in the upper Midwest, United States, and their document imaging system implementation. The last sample is from Midwest University, a private, comprehensive university of about 4300 students located in the Midwest, United States, and their business intelligence project implementation.

The thesis is organized into eight chapters. The two chapters following this introduction provide a literature review of social capital and social network analysis, Communities of Practice, and technology acceptance. Because of the scope of these

topics, the literature reviews are limited to information associated with technology acceptance and specifically, the social influence aspect of technology acceptance. Chapter three concludes with a definition of the conceptual framework for this research.

Chapter four gives a fairly in-depth definition of epistemology and justifies the use of mixed methods. Chapter four goes on to summarize the research methods, the cases, the survey instruments, and the data analysis methods used in this study. The next two chapters present the findings for this research organized into three areas. Chapter five presents the findings from the social network analysis and the UTAUT surveys. It goes on to present findings for proposition 1, hypothesis 1 and 2, the integration of social capital into the UTAUT model. Chapter six presents the findings of proposition 2, the use of social capital to inform membership of a Communities of Practice. A discussion follows in Chapter seven that critically reflects on an organization's use of social capital to support technology acceptance and provides a revised conceptual framework that could be used in future research.

The dissertation concludes with Chapter eight, a summary of this study's contribution to theory, implications for practice, limitations, and interesting recommendations for future research. This research adds to the body of knowledge existing on social network analysis, diffusion of innovations, Community of Practice, and technology acceptance models. It will contribute to the literature by exploring the relationship of social capital and technology acceptance in higher education. In addition, this research hopes to contribute to higher education practice by having a direct impact on the bottom line of colleges and universities by improving the acceptance of new technologies leading to more successful technology implementations.

# 2. Social Capital, Social Network Analysis, and Communities of Practice

> *"Whether people use the term or not, networks are an essential feature of organizations, responsible in large part for organizational effectiveness and innovation" (Cross and Parker, 2004: 131).*

This research explores the use of social capital to support technology implementations. It will propose to use social capital in two ways: first, to better predict an individual's intention to use a new technology and second, to inform membership of a Community of Practice to support a technology implementation. The literature review will be divided into two sections. This chapter will provide an overview of pertinent literature in the areas of social capital, social network analysis (SNA), and Communities of Practice (CoP). Chapter three will explore technology acceptance models and specifically, social influence as a predictor of technology adoption. Chapter three will also provide the conceptual framework for the two propositions of this research.

## 2.1 Introduction

This chapter introduces the concepts of social capital, social network analysis and Communities of Practice. In order to understand how social capital could improve the success of a technology implementation, it is necessary to understand social networks and how to analyze them. This chapter will start with an overview of individual social capital and how an organization can identify individuals with high social capital. It will go on to provide an overview of social network analysis. SNA is a large field of study looking at an individual's position in a network, types of sub-groups within the network, and the structure of the overall network. This literature review will focus on the centrality measures most often used to identify individuals with social capital: degree, closeness and betweenness.

This chapter will go on to summarize how social network analysis is used in organizations to help them better understand their social networks and the social capital residing there, how Information Systems (IS) researchers use social network analysis, and more specifically, how SNA has been used in research to better predict an individual's intent to adopt a new technology. Lastly, this chapter will look at how social capital could be used to support technology implementations. It will explore the relationship between social capital and the social influence construct of the UTAUT technology acceptance model. It will also look at the formation and support of a CoP made up of individuals with high social capital as one means to support a technology implementation.

## 2.2 Social Capital

Most organizations have a formal organizational chart and an informal social network. Research has recognized, that it is the informal social network, that most influences innovation, change, and productivity in an organization (Cross and Parker, 2004). If leaders in an organization understand their social network and the powerful relationships that exist there, they could use that knowledge to promote the adoption of a new technology and ensure a more successful implementation. This section will define social capital and how it can be identified in an organization's social network.

Social network research often associates individuals who have powerful relationships in a social network as being central to that organization (Brass and Krackhardt, 1999). This power, prestige, and social influence can be defined as social capital (Burt, 1992). Individuals with a high degree of social capital may utilize their power to influence others' opinions, attitudes or actions. Finding a means to measure social capital of individuals in a social network and exploring their intent to use a new technology as well as their influence on others' intention to use a new technology could be a powerful addition to the ability of an organization to predict acceptance of a new technology and support a technology implementation.

There are many definitions of social capital. Lin et al. (2001: 3) define capital as "the investment of resources with expected returns in the marketplace." This could

be any type of resource, monetary, economic, or social. This research will define Social Capital as the sum of the actual and potential resources embedded within, available through, and derived from the network of relationships possessed by an individual (Nahapiet and Ghoshal, 1998). Social capital is all about 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 (Kilduff and Tsai, 2003, Borgatti and Foster, 2003, Portes, 1998).

There are a number of ways to look at social capital. One common distinction is to delineate between who profits from social capital, the individual or the group (Lin et al., 2001). Individuals with social capital, leverage their connections to find better jobs, get promotions, learn, get information, solicit support, and generally, improve their own situation (Borgatti and Jones, 1998). Groups, on the other hand, work to develop social capital that brings value to the group as a collective asset (Lin et al., 2001). Researchers such as Bourdieu, Coleman, and Putnam emphasize the collective "good" gained from a society taking advantage of connections and relationships, trust and reciprocity (Borgatti and Jones, 1998).

Social capital from an individual perspective is most pertinent to this research. Lin et al. (2001: 24) state that "it is the interacting members who make the maintenance and reproduction of this social asset possible." They go on to say, "social capital consists of resources embedded in social relations and social structure which can be mobilized when an actor wishes to increase the likelihood of success in a purposive action." This research will focus on just that. It will look at two ways in which an organization can better understand the relationships between individuals in order to increase the likelihood of success of a technology implementation.

First, as will be explored in the next chapter, technology acceptance models are an established means to predicting new technology adoption. These models examine an individual's intention to use a new technology. The models most often incorporate a social influence construct that looks at how individuals influence another person's intent to use a new technology. This research will look at how individual social capital is identified in a social network and how that might influence others behavioral intention to use a new technology.

Second, this research will look at how an organization can utilize individuals with a high degree of social capital to support a technology implementation by improving communication channels and positively influencing others to adopt and use a new technology. A Community of Practice approach will be explored later in the chapter as a means of diffusing a new technology into an organization.

Another way to understand individual social capital is by looking at both the number of relationships and the type of relationships. There have been two schools of thought as to the importance of the number of ties versus the types of ties as a determinant of individual social capital. First is the strong tie theory, where an actor is connected to highly central actors in the organization (Brass and Krackhardt, 1999). The second is the weak tie or structural holes perspective. Researchers assert that it is the absence of ties and being connected to others who are not well connected that provide opportunities to build social capital (Kilduff and Tsai, 2003).

Some researchers feel that the number of ties and the density of an individual's network are important to the creation and maintenance of social capital (Brass and Krackhardt, 1999). People who have close relationships to a large number of highly central individuals is the basis of the "strong tie" argument. Strong ties enable the sharing of important information and the influencing of the attitudes and opinions of others. Therefore, strong ties may be a good determinant of social influence (Brass and Krackhardt, 1999). The disadvantage of a large number of close, personal relationships is the time and energy it takes to maintain them. Another possible concern with a large number of ties is that since similar people tend to develop the closest relationships, the networks tend to be redundant resulting in the sharing of redundant information and resources (Brass and Krackhardt, 1999).

Portes (1998) states that researchers such as Coleman and Loury support the point of view that dense networks are the necessary condition for the creation of social capital; whereas researchers such as Burt and Granovetter take the opposite view. The weak tie researchers posit that it is actually the absence of ties and the weakness of ties that facilitate the creation of social capital (Kilduff and Tsai, 2003). Weak tie researchers posit that is important for individuals to build relationships with people

who are not like themselves and not connected with their close friends (Brass and Krackhardt, 1999). These weak relationships are important sources of non-redundant information and resources. Weak ties also provide the individual with the opportunity to serve as a bridge between differing groups allowing them to control information, broker resources, and mediate change (Brass and Krackhardt, 1999).

A variation or expansion on the idea of weak ties is Burt's structural holes argument. Burt emphasizes the importance of non-redundant ties (Burt, 1992). The gap between non-redundant contacts is defined by Burt as a structural hole (Burt, 1992). It is relationships that are unique and otherwise inaccessible, that give an individual real "social capital" because they provide new, additional information than otherwise would be available to them (Burt, 1992, Lin et al., 2001, Kilduff and Tsai, 2003). It is therefore, not the number of ties that are important, but the ties that link gaps in the social world and therefore link the individual to new information that brings increased social capital (Kilduff and Tsai, 2003).

Structural holes, then, provide entrepreneurial opportunities to broker or control information and resources resulting in the individual's ability to gain more rewarding opportunities and competitive advantage (Burt, 1992). They also facilitate creativity and learning that leads to competitive advantage (Burt, 2000). Strong ties are often important for complex knowledge transfer. On the other hand, weak ties enable simple, yet unique knowledge transfer and brokerage opportunities (Hansen, 1999).

This research will focus on strong ties in that an enterprise-wide technology implementation is a fairly complex knowledge transfer that needs to be spread throughout the organization. It will be important for information to flow to as many people as possible, therefore this research will consider the number of ties and the density of an individual's network as indicators of their social capital.

Social capital is the core of social network analysis (Brass and Krackhardt, 1999). In order to better understand social capital, strong ties, and network density, it is important to have a basic understanding of social network analysis. Researchers use a number of centrality measures as defined in SNA to measure social capital. The

next section provides an overview of social network analysis and the concepts associated with social capital.

## 2.3 Social Network Analysis Overview

One way to identify and measure social capital in an organization is through Social Network Analysis (SNA). SNA is a recognized and established approach for describing organizations and measuring the effects of organization systems (Zack, 2000). This section will provide an overview of social network analysis and provide examples of different ways to look at social networks.

Social network analysis is used by researchers and consultants, like Cross and Parker, to better understand the social structure of organizations across industries (Cross and Parker, 2004). Gartner's 2006 Emerging Technologies Hype Cycle listed social network analysis as high impact (Pettey and Goasduff, 2006). The social structure of an organization is not the same as its formal organization chart. Formal organization charts illustrate an institution's responsibility, authority, and reporting structure. Most employees agree that these formal hierarchical charts do not reflect how work gets done in their organization (Cross and Parker, 2004).

Most people, however, have an innate understanding that it is the informal relationships and networks that really influence the performance of an organization (Cross and Parker, 2004). It is the informal social networks that contains the power and influence, or social capital, to get things done, effectively communicate, and effect change (Cross and Parker, 2004). Social network analysis provides the tools to better understand organizational structure and employee behavior such as commitment, satisfaction, job-related rewards, influence and power, and conflict (Perry-Smith and Shalley, 2003).

SNA resides within the social and behavioral sciences and is made up of a number of theories, models and applications. Unlike traditional social science research that focuses mostly on the attributes of the sample being studied, SNA focuses on relationships between actors, can look at both the micro and macro level of the

sample being studied, and can integrate quantitative, qualitative, and graphical data allowing for a more in-depth, comprehensive research project (Kilduff and Tsai, 2003). As Kilduff and Tsai (2003: 127) write, "The social network approach to organizations consists of a distinctive set of concepts that focus on systems of relations that can be represented and analyzed graphically and quantitatively."

There are several key components that comprise SNA: actor or node, relational tie or link, dyad, triad, subgroup, group, relation and network (Wasserman and Faust, 1995).

- An actor, or node, represents the unit of analysis. It can be a person, a technology, groups, or organizations The particular actor being studied is called the ego and the other individual in a paired relationship is labeled the alter. These actors are interdependent and their position in the network influences their opportunities, constraints, and behaviors (Wasserman and Faust, 1995, Hanneman and Riddle, 2005, Zack, 2000).
- Relational ties represent the myriad of ways actors can be linked to one another. Actors can talk to each other, be friends, share information or resources, evaluate each other, be married, etc.
- Dyad is the most basic relationship, or tie, between two people. Most social network analysts use dyads as the basis of their statistical analysis (Hanneman and Riddle, 2005). Focus is placed on the properties of the pair, whether ties are reciprocated or not, and whether or not multiple relationships exist.
- Triad represents a subset of three actors and their possible ties or links.
- Subgroup can be defined as any subset of actors and the ties associated with it. Studying subgroups, such as cliques, will be an important aspect of this research.
- Group represents the collection of all actors being measured in a particular study. Groups represent the boundary of the sample being studied and must have a theoretical, empirical or conceptual reason to belong together (Zack, 2000, Wasserman and Faust, 1995).
- Relation represents the types of ties represented in the group. This term refers to the collection of ties of a particular type measured on pairs of actors

from a specific group or subgroup. The ties defined above belong to specific pairs of actors.

- Social Network is a finite set of actors and their relationships.

SNA is heavily reliant on graph theory (Hanneman and Riddle, 2005, Haythornthwaite, 1996, Cross and Parker, 2004, Berry et al., 2004). Socio-grams are used to represent social networks. Points on a graph represent nodes and lines represent ties or relations. Graphs represent relationship networks among people and identify patterns of interaction visualizing sub-groups, cliques, and other organizational structures. A common approach to graphing is to represent each actor in a population with a labeled circle or other shape that distinguishes types of people. Coloring, shading, shapes and sizes are used to represent attributes of individual nodes.

The lines between pairs of actors represent an existing tie or relationship of some sort. These ties mean a different thing based on the relationship being studied. The strength of the relationship, such as intensity or frequency, can be represented by the thickness or type of line used. Arrows at the end of the lines denote the direction of the tie or relationship. Reciprocity or directionality in relationships can indicate very different things about the actors such as expertise, bottlenecks, or drains on other people's time.

Socio-grams make it easy to identify relationships between members of the network. An individual's eye immediately notices that Joy in Figure 2.1 holds a central position in this network. This socio-gram contains arrows on one or both ends of each line. This represents a directed network and indicates which direction the particular relationship is going.

For instance, in Figure 2.1, if this is a communication network, Fred considers himself to communicate with Joy. However, Joy does not reciprocate nor communicate with Fred. On the other hand, Joy and George reciprocate their communication which is indicated by an arrow on both ends of the relationship. It is

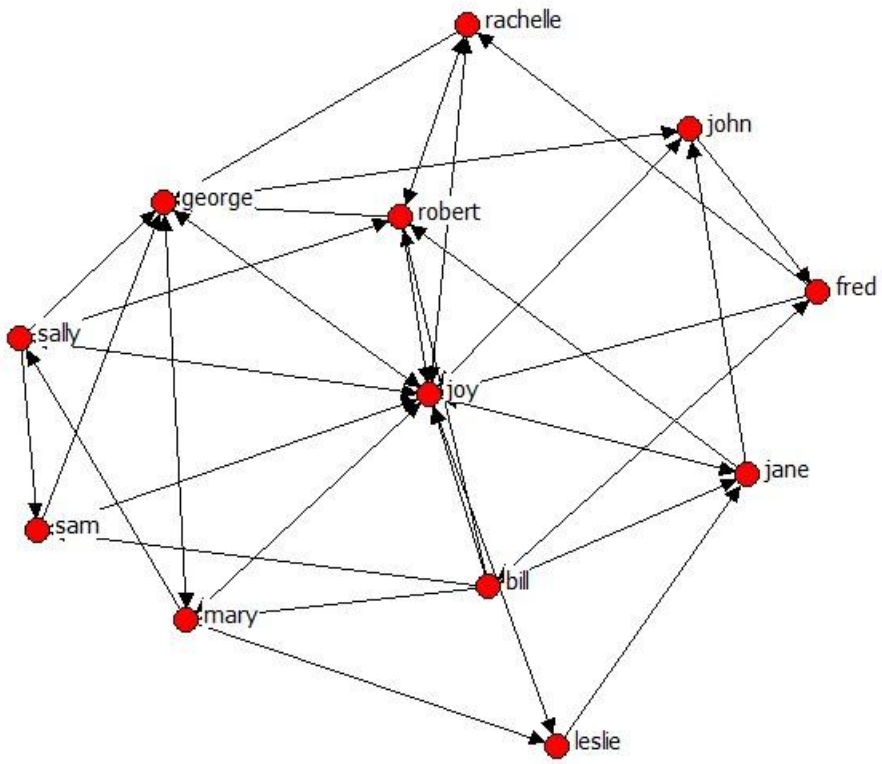


Figure 2.1: Sample Socio-gram

possible to have undirected networks depending on the research being conducted. Undirected networks would indicate that the direction is not pertinent, for instance if the network measures whether or not two people lived near each other (Wasserman and Faust, 1995). If Joy lives near Leslie, then, of course, Leslie lives near Joy and the direction of the relationship does not matter.

Another type of network is a valued or a non-valued network. Network information can be comprised of valued relations where the strength of the relationship is recorded (Wasserman and Faust, 1995). The lines, or relationships, in Figure 2.1 are all the same size indicating that this is a non-valued network. If Figure 2.1 represented a valued network, the thickness of the lines could indicate the strength of the relationship. In this example, if the communication strength had been gathered, the lines could have been thicker or thinner depending on how often the individuals communicated with each other.

Other types of valued networks measure emotional intensity, amount of time spent with another person, and the number of occurrences (Kilduff and Tsai, 2003). Value

strength ranges from weak, e.g. an individual may only talk to a particular person once per year, through strong, e.g. where an individual works with a particular person to solve problems on a daily basis. Relationship strength can be linked back to strong and weak ties where research has shown that weak ties facilitate simple information exchange and strong ties facilitate the communication of complex knowledge (Kilduff and Tsai, 2003). This research will look at valued networks and strong ties as indicators of social capital and the potential for complex knowledge transfer to support technology implementations. To better understand how information moves between nodes and relationships, the next section will provide an overview of three theories that look at how information moves through an organization's social structure.

### 2.3.1 Social Network Analysis and Social Structure

By understanding an organization's social structure, it could be possible to manipulate the network's flow of resources for an organization's, group's or individual's strategic advantage. There are three concepts that describe this flow of resources, or dissemination of information and ideas, into organizations. First, the diffusion of innovations theories (Frank et al., 2004, Valente, 2005, Rogers, 2003, Rogers, 1995) assert that new ideas, innovations, procedures and practices diffuse or spread through an organization by interpersonal relationships, mostly by interpersonal communication.

Rogers (1995) lists four main elements of diffusion: innovation, communication channels, time, and the social system. These elements are all relevant to this research. Rogers (1995: 11) defines innovation as "an idea, practice, or object that is perceived as new by an individual or unit of adoption." Most of Rogers' research is on technological innovations consisting of two components, hardware and software. The hardware being the tool and the software, the knowledge or instructions needed to achieve a desired outcome (Rogers, 1995). An enterprise-wide technology implementation falls into this category of technological innovations where the new information system is the "hardware" and the knowledge to use it, the "software".

The second element, communication, is defined by Rogers (1995: 17) as "the process by which participants create and share information with one another in order to reach a mutual understanding." Diffusion is concerned with the sharing of information on a new idea or innovation. Relevant to this research is the findings of Rogers' research in that people do not necessarily evaluate and adopt an innovation based on a logical analysis of the consequences, but rather on a subjective evaluation based on the opinions of others who have already adopted the innovation (Rogers, 1995). This finding illustrates the importance of relationships and interpersonal communication channels in the adoption process to an organization.

Time, the third element, is involved in the diffusion process in two ways (Rogers, 1995). First, as part of the innovation-decision process and the time it takes an individual to move through the process: knowledge, persuasion, decision, implementation, and confirmation. Second, as a means of labeling an individual as to their adoption of the innovation, early or late, as compared to other members of the social system (Rogers, 1995). Time is of importance to this research in that it is concerned with IS implementations and the ability of an organization to improve the innovation-decision process resulting in increased adoption and usage.

Social system, the fourth element, is defined by Rogers (1995: 23) "as a set of interrelated units that are engaged in joint problem-solving to accomplish a common goal." Social structure influences innovation in that it defines the boundary within which the innovation will be diffused. Rogers' definition of social structure contains many of the elements that this research is interested in, such as the effect of societal norms on diffusion and the roles of opinion leaders and change agents (Rogers, 1995). Rogers' theory takes into account the norms or accepted behavior patterns of the social structure and how different the innovation is from those norms in understanding the diffusion process. Innovations that are different from the norm have a much more difficult diffusion process which is important when looking at an IS implementation and the subsequent changes to an individual's work habits.

Rogers (1995) goes on to look at two types of individuals in a social structure that influence innovation, the opinion leader and the change agent. An opinion leader represents informal power in an organization and an individual's ability to influence

other individuals' attitudes and behaviors. System norms have an influence on opinion leaders. If the system is predisposed to innovation and change, then opinion leaders tend to be innovative. Any system can have both innovative opinion leaders as well as those opposed to change (Rogers, 1995). Either way, opinion leaders tend to be at the center of their communication networks. These traits are consistent with our definition of individuals with social capital or those central in their informal social networks. This research is concerned with the relationship of those with social capital, or opinion leaders, and the adoption and implementation of a new technology.

The second type of individual described by Rogers (1995) as an influential part of the social structure and important to diffusion is a change agent. These individuals are professionals who represent the organization outside of the social system and attempt to influence individuals within the social system to change and adopt innovations that are desirable to that organization (Rogers, 1995). Change agents attempt to use opinion leaders in the social system to diffuse innovation in a manner of their choosing. Change agents are similar to organization leaders and project managers who are responsible for a new technology implementation.

Diffusion of innovation theories attempt to understand why some actors of a population adopt a new idea or innovation and others do not. Another school of research posits that the social structure influences adoption through contagion, where the likelihood to adopt a new idea increases as others who are connected in an individual's personal network adopt it (Valente, 2005). Social contagion, the second theory, as described by Burt (1987) occurs when connected individuals work together to manage change and innovation. The spread of an idea, new practice, or perhaps a new technology is determined by existing friendship or other relationship channels (Borgatti and Foster, 2003). Borgatti and Foster (2003: 1005) go on to say that "the adoption of a practice is determined by the proportion of nodes surrounding an actor that have adopted, while the timing of adoption is a function of the lengths of paths connecting the actor to other adopters." Understanding the flow of resources in the organization, provides the opportunity to intercede where needed and manage where appropriate to ensure ideas, practices, or innovations are disseminated strategically and efficiently.

Research on the concept of contagion is very much still in progress, with much more to be done with longitudinal studies and intentional intervention action research in order to show in quantitative terms that contagion occurs via social influence (Valente, 2005). The research is showing that social networks do influence the spread of new ideas and processes because, as stated by Valente (2005: 113), "people acknowledge that they receive information and influence via their social networks and they model the behavior of others." The adoption of a new technology is an example of a new idea or innovation. Therefore, the implementers of a new technology tool or application can learn from these theories and employ their lessons in order to better facilitate a technology implementation.

Third, the concept of embeddedness is the idea that work-related decisions and interactions result from social relationships (Borgatti and Foster, 2003). Businesses and individuals tend to feel more comfortable doing business with those that they have a friendship, comfort-level, kinship with (Kilduff and Tsai, 2003). Individuals tend to make relationships with people similar to themselves. These interactions are not always the most profitable or economically sound. According to the concept of embeddedness, an individual may get that promotion because of who they know, not because they are the most qualified. Also, an organization might get the "bid" not because their proposal was the best, but because they had an established, positive relationship with the requesting organization. Therefore, an individual may intend to use a new technology because a person he is close to intends to use that technology.

By understanding the social structure and how information flows through the informal social network, organizations can utilize SNA as a powerful tool to improve the productivity of their business units through better communication, problem solving and innovation (Kilduff and Tsai, 2003). This research will focus on central individuals in an organization's informal social network in order to better predict technology adoption and assist in the diffusion of innovation in the form of a new technology. The next section will provide an overview of social network analysis and its use with social structures and individuals.

### 2.3.2 Social Network Analysis Measures

Social network analysis provides researchers with a variety of tools to better understand social structures, the relationships among individuals, and the implications of those relationships (Wasserman and Faust, 1995). Following Hanneman and Riddle's (2005) organization of network measures, this section will look at social network analysis measures organized into three main categories: connections, embeddedness, and ego.

The first set of tools has to do with the connections and relationships among individual members of a social network as well as the network as a whole. In a social network, some individuals are well connected and others are not. The number and type of connections has implications. As has been outlined before, the number of relationships could mean that some individuals are exposed to more and different information than others. How close an individual is to others may indicate a means for more frequent and faster information sharing. How the entire social network is connected has implications as well. Populations who are closely connected may be better able to solve problems through the use of diverse perspectives as well as pull their resources together more efficiently to meet strategic goals (Hanneman and Riddle, 2005).

The following measures are used in SNA to provide information to researchers and practitioners on the connectivity of social networks and their members (Hanneman and Riddle, 2005):

> Degree is the basic tool to look at connectivity by measuring the number of incoming, outgoing, or reciprocal ties an individual has in relation to the total number of ties available in the social network.
>
> Density is the proportion of all possible ties that are actually present in the network being measured. Density can indicate how fast information can diffuse through a network.
>
> Reachability measures whether or not an individual is reachable by another through any set of connections. If a particular actor is unreachable by others, this could indicate a division of the social structure or it could illustrate that the network is made up of more than one population.

Connectivity looks at whether there is a direct connection from one person to another, whereas reachability looks at any connection. Connectivity is another indicator of how information moves through an organization specifically in the context of dependency and vulnerability.

Distance measures how an individual is embedded in the social network by looking at how close they are as well as how many ways they are connected to each other. Distance provides insight into how long information takes to move through the network.

The second set of SNA tools help an organization better understand the big picture of the social structure within which individuals are embedded (Hanneman and Riddle, 2005). These tools help researchers understand how strong the ties are among groups of individuals as well as the size and strength of those groups within the overall structure. The smallest social structure consists of three individuals in that it takes three people to create a variety of dyadic relationships. This is the smallest number of people that can form self, other, and hierarchical relationships. Hanneman and Riddle (2005) posit that most people interact with a small group of others and that these groups form clusters that provide insight into how the social structure works and the overall constraints on individuals that occur based on their connections.

Density looks at the degree of ties between two individuals in a social structure and provides insight into the social life of the populations.

Reciprocity is similar to density but takes into account the direction of the relationship and whether or not the ties are reciprocated. Some researchers assert that un-reciprocated relationships are unstable and that a social structure where most of the ties are either null (no tie) or reciprocated result in a stable social structure.

Transitivity looks at the types of relationships that occur with triads, or groups of three individuals. SNA researchers use transitivity to better understand hierarchy, equality, and exclusivity of the social structure by looking at sixteen possible types of ties that can occur among three people.

Clustering measures the local "neighborhood" of a particular individual, or all the people that a person is connected to, as well as the density of that neighborhood.

The third set of tools looks at the individual, or ego. The ego tools attempt to indentify the opportunities and constraints that exist for specific individuals by measuring the variation across individuals in the way they are embedded in their social structure (Hanneman and Riddle, 2005). Unlike the last set of tools that focused on sets of three individuals, this set of tools focus on binary data, or the relationships between two people.

Egonet looks at an individual's relationship with all others and creates data on their individual neighborhood. It can be used to better understand that person's place in their social structure.

Ego density provides a perspective on an individual's neighborhood based on direction of the relationships, size, and distance. These measures can provide insight into how central and powerful a particular person is within their own neighborhood.

Structural holes, as mentioned earlier in this chapter, looks at an individual's location in the overall social structure and the advantage or disadvantage that could be gained from that position.

Brokerage is another way to look at how an individual is embedded in the social structure and how a person can use their relationships to connect groups of others. Brokerage examines the instances where a person sits between two others and has the potential to serve as a broker, to exchange information or exert some type of influence.

All of these measures are important to researchers as a means of understanding an organization's social network and the relationships that could help or hinder information flow and the diffusion of innovation such as a new technology implementation. Many of the measures provide insight into an individual's degree of social capital and their potential for influencing others. The next section will summarize the most common SNA measures used to identify central individuals, or those with high social capital, in an organization.

### 2.3.3 Centrality

The SNA tools summarized in the last section highlight the variety of ways social network researchers can look at a social structure in an organization and the social capital residing there. Many of the measures provide an indication as to the flow of resources and information within a social network leading to the organization's propensity for managing change and adopting new ideas. This section will look at key actors in the social structure in order to better understand who is most central and has the most impact on the sharing of information, managing change, and facilitating innovation. This section will explain the concept of centrality and how it can be measured.

Linton Freeman (1978: 217) states in his seminal work that "everyone agrees, it seems that centrality is an important structural attribute of social networks". He goes on to say that there is, however, no agreement on what centrality is or on its conceptual frameworks. Since 1979, much research has been done on centrality. Most researchers have decided that there are three main centrality measures: degree, closeness, betweenness. Others add the eigenvector measure as a fourth measure of centrality (Leydesdorff, 2006, Krackhardt, 1992, Brass and Burkhardt, 1992, Rowley, 1997, Zemljic and Hlebec, 2005).

Freeman (1978) describes centrality in social networks as the hub of a wheel or the center point of a star (see Figure 2.2). This visualization helps individuals to understand that to be central in an organization is to be located in a position with the most connections and relationships. 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). This position can be defined as having three properties: the maximum possible *degree*, or connections to others; located on the geodesics, or the shortest distance, *between* the largest possible number of other point;, and is the minimum distance from all other points or the *closest* to them (Freeman, 1978).

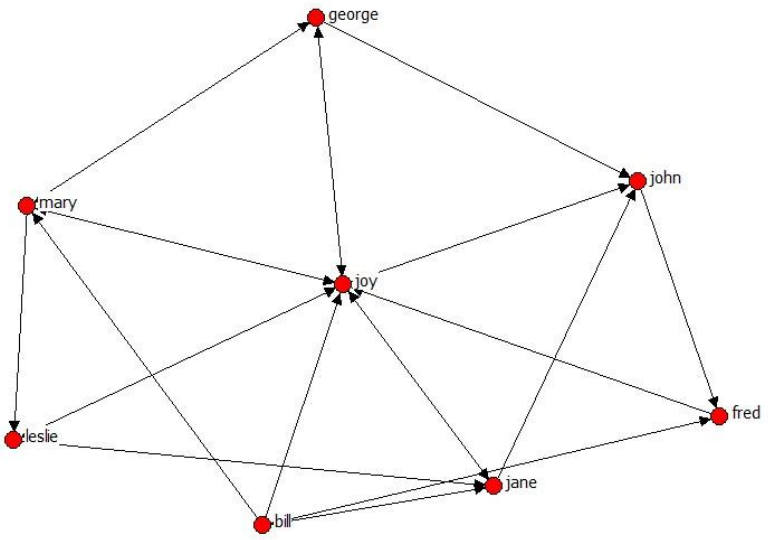


Figure 2.2: Centrality

Degree centrality is perhaps the most straightforward measure in that it counts the number of ties or connections to a particular individual in the social network (Wasserman and Faust, 1995, Zemljic and Hlebec, 2005, Rowley, 1997, Brass and Burkhardt, 1992, Cross and Parker, 2004). The greater the number of ties, the greater the opportunities to receive and distribute information and resources, and therefore the greater the power (Brass and Burkhardt, 1992, Hanneman and Riddle, 2005).

The number of outgoing or incoming ties can also be interpreted as an important degree centrality measure (Cross and Parker, 2004). An individual with a high number of incoming connections illustrates that many people choose to go to that individual for information, advice, or help in problem solving (Krackhardt, 1992). An individual with a high number of outgoing ties can be interpreted as someone who chooses to collaborate with or reach out to others in problem solving (Krackhardt, 1992, Cross and Parker, 2004).

A person with high centrality as measured by degree is often considered to be "where the action is" and "well-connected"; therefore, a prominent and respected central member of the organization (Rowley, 1997, Wasserman and Faust, 1995). This individual may be looked upon by others as a major channel of information, someone they trust to go to for advice (Wasserman and Faust, 1995). Conversely,

individuals with low degree centrality appear to be on the outskirts of the network and not active in the relational process (Wasserman and Faust, 1995). They may feel isolated from the organization or their low degree of centrality may be perfectly normal, as their job functions do not necessitate this type of relationship (Cross and Parker, 2004).

The second centrality measure is betweenness. An individual who may have a low "degree" centrality or a small number of connections to others, may still hold an important central position in the network depending on where they sit in relationship to others (Scott, 2000). Betweenness centrality looks at the extent to which an individual could be a go-between for other pairs of actors in the network because they occupy a position on the network that is along the shortest, most efficient or geodesic path, between two individuals (Freeman, 1978, Kilduff and Tsai, 2003, Leydesdorff, 2006, Costenbader and Valente, 2003, Rowley, 1997).

Being located in the middle, by virtue of this position, the individual can serve as a broker or gatekeeper and has some control over the flow of information and interactions or interpersonal influence over others (Leydesdorff, 2006, Freeman, 1978, Brass and Burkhardt, 1992, Krackhardt, 1992, Scott, 2000, Wasserman and Faust, 1995). Betweenness then can be used to measure power in communication networks because the "between" individual has the control to withhold or distort information as it flows through the organization. This gatekeeper, or broker, by controlling information, can also increase the dependence of others to himself (Freeman, 1978, Brass and Burkhardt, 1992).

A high measure of betweenness can also indicate an individual's connectivity with non-redundant sources of information. To the extent that a person is connected to otherwise disconnected parts of the network, they have access and control over unique sources of information resulting in a higher betweenness score (Krackhardt, 1992). Freeman et al. (1979) wrote that betweenness, then, is the centrality measure of choice when it comes to understanding leadership nominations since it is based on potential for controlling communication. Freeman et al. (1979: 128) go on to state, "This outcome makes good intuitive sense; it is reassuring to find that perceived leadership is related to what we have called 'control potential'."

Cross and Parker (2004) incorporate the idea of betweenness to define two types of central people, the unsung hero and the bottleneck. Unsung heroes are those that share information across groups, engage in problem solving, and actively collaborate with others to get work done. They are often not recognized by formal organization charts or performance management systems. Unsung heroes could potentially assist in new technology implementations by sharing information, encouraging others, and collaborating across groups in problem solving and finding 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 impacting 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. Again, formal organization charts and traditional management techniques do not often identify these individuals. Bottlenecks could potentially hinder technology acceptance by negatively impacting the sharing 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.

In 1991, several years after his 1978 seminal work on centrality, Freeman et al. expanded on his view of betweenness to include all the paths connecting pairs of actors while earlier binary measure took into account only the geodesic, or most efficient, path (Freeman et al., 1991). Freeman et al. (1991) defined flow betweenness centrality for an actor as the extent to which flow between other pairs of actors in the network would be reduced if the observed actor were removed from the social network (Freeman et al., 1991, Leydesdorff, 2006, Zemljic and Hlebec, 2005). Flow betweenness is therefore the measure of the contribution of an actor to all possible maximum flows (Zemljic and Hlebec, 2005).

Flow betweenness adds a different perspective to centrality than degree centrality. Degree centrality is used to explore the relationship between those who have the most connections in the network. On the other hand, the flow betweenness

centrality measure is used to explore the relationship of those who control the flow of information to those individuals that they sit between.

Burt's structural holes concept described earlier in this chapter incorporates the concept of betweenness. A structural hole exists when an individual has a connection to person A and person B, but person A and B do not have a tie to each other. In Figure 2.2, Joy has a connection to Bill and a connection to Leslie, but Leslie and Bill are not connected to each other resulting in a structural hole. Joy sits between Bill and Leslie and has an advantaged position (Hanneman and Riddle, 2005). Joy controls the flow of information between Bill and Leslie as well as those with whom they are connected.

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 centrality, 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). Closeness centrality measures the distance of an individual to all others in the network (Hanneman and Riddle, 2005). The longer the distance, the smaller the closeness. Even if an individual has only a few connections to others or low "degree" centrality, she may have high closeness centrality in her social network because she has relationships with others who are highly central.

Freeman associates closeness centrality with independence and efficiency (Freeman, 1978). First, how "close" a person is to all others in their social network can be interpreted to represent efficiency because she can communicate with, share resources with or problem solve with others efficiently due to using the shortest number of steps (Brass and Burkhardt, 1992, Cross and Parker, 2004, Wasserman and Faust, 1995). Second, by being close to all others in a social network, an individual may possess a certain degree of independence because she has multiple paths of communication and can avoid the control of others (Brass and Burkhardt, 1992). Conversely, an individual possessing low closeness centrality is highly

dependent on others for access to information and resources from other areas of the network (Brass and Burkhardt, 1992, Rowley, 1997).

Cross and Parker use closeness measures to identify two types of central individuals: boundary spanners and information brokers (Cross and Parker, 2004). Boundary spanners provide a crucial role in the organization in that they link two separate groups of individuals who are often separated by functional area, physical space, or hierarchy. Boundary spanners are important to organizations when they need to share expertise and information, develop new products, or meet strategic goals. Boundary spanners can also assist an organization when implementing large-scale change, like a new technology implementation.

Information brokers are those individuals who are close to all others in a network, even people they are not directly connected to. They may have the shortest path from one end of the network to the other. They have the potential to impact information sharing among the entire network. Organizations can utilize information brokers to share information or expertise across the network. Organizations could potentially leverage information brokers by getting them on board with new technologies first and sending them out to disseminate the benefits to the rest of the organization.

Perry-Smith and Shalley (2003) assert that actors with high closeness centrality tend to feel more comfortable taking informed risks. They also state that closeness centrality facilitates creativity, unless centrality is so high that stress and conflict become overwhelming and the breadth of knowledge becomes constraining (Perry-Smith and Shalley, 2003). Therefore, this research will use closeness centrality to explore the relationship between individuals intent to use a new technology and the efficiency with which they share their intent with those they are close to in their social network.

This section outlines the three most common measures of centrality: degree, closeness and flow betweenness. These measures are most accepted and, as outlined below, offer unique perspectives on social influence. This research will focus on these three measures as the primary indicators of individual social capital due to the

fact that they are the most common and well-established individual measures available to social network researchers. The next section looks at how an individual's social capital may lead to their ability to influence others and how an organization could use this influence to support a technology implementation.

### 2.3.4 Influence Measures

A result of an individual's social capital is their influence over others in shaping opinions, attitudes, and action. In social network research, an individual's opinion, attitude, and actions, and by extension, their intent to use a new technology, is influenced by those close to them in their social network (Friedkin, 1998, Friedkin, 1993). Friedkin (1993) discusses two main components of social influence, visibility and salience. First, an individual must know what others' opinions are, they must be visible. Second, an individual's influence on the other depends on the salience or value of their opinion to the other person (Friedkin, 1993). Visibility and salience are affected by three social structures: cohesion, similarity and centrality (Friedkin, 1993, Friedkin, 1998).

Friedkin (1993) posits that the greater the structural cohesion, the more likely network members will influence each other. The more cohesive the network, the more rapid information flows through it and therefore, the more likely opinions will be shared and known to each other. Cohesive groups also tend to place more value in the opinions of others. Second, the more similar the actors' positions are to each other, the more similar their initial opinions are likely to be. Individuals who occupy similar social positions, roles, status, or position in social network, tend to initially look at situations the same way. Structural similarity may induce a competitive orientation in which one is attentive to the others' opinions or behaviors that bear on status and interests.

Lastly, central actors tend to have more influence over others than peripheral actors. An individual's social network position contributes to their social power. Central actors more readily acquire information resources that allow their opinions to become influential over others. These central individuals, those with social capital,

are likely to have more and shorter communication paths and they are likely to use those paths to share their opinions with others.

This concept of social influence is important to this research in that it can be a predictor of technology acceptance and use. The next chapter will go into social influence as associated with technology acceptance much more in depth. The next section will look at how researchers have used social network analysis in the Information Systems industry.

## 2.4 Social Network Analysis in the Information Systems Industry

Social network analysis is widely used in research and seems to be a good fit for supporting technology implementations. There has been some exploration of the use of social networks in the Information Systems' (IS) context. In a literature review of the top fifteen Management Information System (MIS) journals, as ranked by the Association for Information Systems (AIS) (http://www.isworld.org/csaunders/rankings.htm), it was found that IS researchers were incorporating aspects of social networks when looking at knowledge management, performance, changes to organizational structures, and self reflection (Saunders, 2008).

Effective knowledge management and the technologies that support it are considered by many organizations as a strategy that leads to organizational competitive advantage (Sherif et al., 2006). Researchers have looked at the relationship between knowledge creation and an organization's social networks and the associated accumulation of social capital (Sherif et al., 2006, Wasko and Faraj, 2005). To better understand knowledge creation and the associated technologies to support it is one way SNA is used in IS research.

In addition to improving knowledge management, IS researchers have utilized social network analysis to better understand individual, team and organizational performance. As far back as 1994, Rice (1994) looked at e-mail communication and network data from a social network perspective to better understand communication

patterns and individual performance. Research has used SNA to analyze network structures and interaction patterns to better understand production teams. For instance, researchers have found correlations between an individual's network centrality and performance in teams (Ahuja et al., 2003, Gloor et al., 2008, Braha and Bar-Yam, 2004). Other research has focused on software development teams and their social structure in relationship to performance (Long and Siau, 2007, Yang and Tang, 2004). Still other research has used social network concepts to mine business process log files. Van der Aalst et al. (2006) combined concepts from workflow management and SNA to better understand an organization's social network through the analysis of the processing of invoice log files with the goal of improving organizational performance.

Social network structure or organizational structure is another area that integrates SNA into IS research. Zack and McKenney (1995) researched the use of electronic messaging in performing tasks by management groups, focusing on the effects of new technology on social structure and relationships after implementation. This is somewhat different than this research which focuses on how the existing social structure can support technology acceptance prior to implementation. Five years later, Zack (2000) used SNA to review three studies and analyze how IT implementations effect organization structure and communication patterns. Hislop et al. (2000), during the same time period, explored the relationship between hierarchical power, knowledge sharing, and networks during the early stages of ERP implementations. They found, in their longitudinal study of two case organizations, that the development of knowledge and networks is intricately connected with an organization's hierarchical power and politics (Hislop et al., 2000).

In 2002, Murphy and Chang (2002), reported on how enterprise-wide technology implementations change organizational structure as well as how social networks influence individuals use and opinions of the technology. Newell et al. (2002) also looked at ERP implementations and the influence of social capital on knowledge transfer in two case organizations where one implementation was successful and the other was not. Researchers such as Light and Wagner (2006) and Howcroft and Light (2006), without using formal SNA methods, looked at the relationship between packaged enterprise-wide information systems implementations and power

within organizational structures. More recently, Davidson and Chismar (2007) looked at how a computerized physician order entry (CPOE) impacted social structures.

SNA has also been used in IS research for self-reflection. Ahuja (2002) reflected on the effects of social and structural factors on gender differences in IT career choices, retention and promotion. She posits the use of social network analysis to assist in indentifying and removing barriers to women in the IT profession. Vidgen et al. (2007) employed SNA to reflect on the European Conference on Information Systems (ECIS) research community. Their research looked at who is central in ECIS and interventions that could potentially improve the research community. They also reflected on the usefulness of SNA as a method to support IS research.

This section provided an overview of how SNA is being used in information systems research. The next section narrows the discussion and looks at how SNA is used specifically in technology adoption IS research.

### 2.4.1 Social Network Analysis in Technology Adoption Research

In addition to the use of social network concepts described above, there has been some social network research in relationship to technology acceptance. Burkhardt and Brass (1990) looked at the effects of a change in technology on individual and network structure, specifically on the relationship between centrality, power, and the timing of adoption of a new computerized information system. They found that early adopters increased their power and centrality in the network and that the organization's network structure changed as a result of the IT implementation.

In addition, two studies looked at attitudes towards technologies in the social context. Rice and Aydin (1991) used social information processing theory and found that individual attitudes toward an integrated health information system were influenced by the attitudes of socially proximate others. Fulk (1993) looked at the relationship of individual attitudes to e-mail communication and work group affiliations in a group of scientists and engineers. They found that social influences

on technology-related attitudes and behavior were consistently stronger when individuals were highly attracted to their work groups.

In another study that looked at work groups, Chatfield and Yetton (2000) explored how central or peripheral a specific Electronic Data Interchange (EDI) network is to managing inter-firm interdependence. They found that high embeddedness motivates adopter strategic use and low embeddedness deters use of the EDI network.

Frank et al.'s (2004) research looked at how social networks impact the implementation of computer technology in six K-12 schools. Using Diffusion of Innovation theory, they analyzed the effects of perceived social pressure and the access to expertise on the acceptance of a new technology. They found that change agents may be able to utilize social capital to aid in the implementation of innovations (Frank et al., 2004).

### 2.4.2 Gaps in the Literature

This literature review validates the appropriateness of the use of social network analysis in IS and technology acceptance research. However, gaps exist in the literature in using formal social network analysis in combination with a technology acceptance model such as the Technology Acceptance Model (TAM) or the Unified Theory of Acceptance and Use of Technology (UTAUT). The top fifteen IS journals (Table 2.1) were searched for keywords "social network analysis" and "technology acceptance" (Saunders, 2008). Although there is a substantial body of literature on each topic alone, social network analysis or technology acceptance model, a combined search resulted in no articles.

No literature was found that incorporated social network analysis into the use of the UTUAT model with the goal of better understanding the social influence construct. Although, the use of social network analysis to quantifiably measure social influence in UTAUT seems to be a legitimate research focus (Vidgen et al., 2007), minimal, if any, research is being done in this area. There does seem to be growing interest, however, by IS researchers in social network analysis as evident by a special track in

both the 2008 European Conference on information Systems and the 2008 Americas Conference on Information Systems.

| | |
|---|---|
| 1 | MIS Quarterly |
| 2 | Information Systems Research |
| 3 | Communications of the ACM |
| 4 | Management Science |
| 5 | Journal of Management Information Systems |
| 6 | Artificial Intelligence |
| 7 | Decision Sciences |
| 8 | Harvard Business Review |
| 9 | IEEE Transactions |
| 10 | AI Magazine |
| 11 | European Journal of Information Systems |
| 12 | Decision Support Systems |
| 13 | IEEE Software |
| 14 | Information and Management |
| 15 | ACM Transactions on Database Systems |

Table 2.1: Top 15 IS Journals (Saunders, 2008)

This section focused on the gap in the literature on the use of social capital to predict technology adoption. The next section will explore how an organization could use the social capital residing in their social network to support a technology implementation by looking at a social structure called Community of Practice (CoP).

## 2.5 Communities of Practice

This research explores the use of social capital to support organizations in the adoption and usage of new technologies. This section provides an overview of a social structure labelled Communities of Practice (CoP). The literature will show that a CoP may be the type of structure necessary to facilitate the use of social capital in supporting a technology implementation. The term, Communities of Practice, 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 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. Communities of Practice are also different from a formal work group whose purpose is to deliver a product or a service. Formal works groups are officially defined in a company's organizational chart and have defined job duties, goals and outcomes (Wenger and Snyder, 2000).

CoP, on the other hand, work to 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). Theory suggests that for people to learn, they must participate in community (Davidson and Heslinga, 2007). Knowledge is generated through social, communal activities (Hislop, 2003). The social structure of CoP serves as vessel through which knowledge can be produced through experience and community participation (Davidson and Heslinga, 2007).

Communities of Practice have been found to diffuse knowledge into an organization in a number of ways (Wenger, 1998). First, members of the CoP tend to have hands-on knowledge of processes and they know what is appropriate to communicate to the organization. CoP can serve as excellent communication channels for moving information or diffusing innovation into an organization. Second, CoP retain knowledge in ways that are practical and applicable to organizations (Wenger, 1998). Since they are working hands-on, in community to generate knowledge, their outcomes are much more relevant than manuals or technology documentation received from vendors. Therefore, CoP could be used by organizations to train and orient users on a new technology tool.

Third, a good CoP is innovative and open to change (Wenger, 1998). They tend to discuss new and exciting ideas that move their organization forward. If the CoP is

committed to the diffusion of a new technology, for instance, they may take a personal investment into ensuring its success. Fourth, a CoP is a community and a place for people to feel they belong (Wenger, 1998). Wenger posits that having a sense of identity is important for organizational learning (Wenger, 1998). In a technology implementation, for instance, it would provide a place for individuals to feel they belong and the ability to focus on moving the technology forward. All four 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 (Wenger et al., 2002, Cox, 2005).

Hislop's research, in the implementation of IT based process innovations, provides a link between this social structure and technological innovations (Hislop, 2003). Hislop wrote (2003: 164), "communities of practice literature suggests, organizational communities of practice both shape the structure of the organizational knowledge base, and represent important reservoirs of organizational knowledge, they have the potential to play an important role in the implementation of technological innovations." Three primary characteristics of CoP were identified that facilitate the knowledge sharing of innovations. CoP generally possess a common, shared knowledge base, they often share values and attitudes, and they possess a sense of collective/group identity (Hislop, 2003). Hislop posits that these characteristics are powerful and can influence innovation processes in organizations.

Hislop's research involved seven detailed longitudinal case studies focusing on the process and dynamics of implementation projects and pre-existing CoP (Hislop, 2003). This research found that CoP both supported and hindered technology innovation in their organizations. In two of the case studies, CoP negatively influenced the innovation projects. In both organizations, the culture was one of autonomy and isolation. The CoP felt they would be negatively affected by the innovations and therefore, did not participate or cooperate with the process (Hislop, 2003). Hislop found that when innovations introduced major differences in work practices and that "the conflict and tensions this produced resulted in organizational communities of practice not supporting these innovations" (Hislop, 2003: 182). This finding is consistent with Rogers' emphasis on social structure and the

difficulty of diffusing innovation when the outcomes are much different from the established social norms (Rogers, 1995).

On the other hand, two of the case studies resulted in Communities of Practice that significantly supported the technology implementations (Hislop, 2003). The organization's project management and technology leadership techniques seemed to be the main source of this success. Implementation leaders in those organizations created a sense of involvement, ownership, and participation among the CoP which resulted in the CoP feeling valued, involved and ultimately in full support of the innovation. These CoP supported the innovation by significantly influencing the attitudes and behaviors of others in their social structure (Hislop, 2003).

Therefore, it is important for an organization to effectively nurture CoP, as a tool to support technological innovation. In fact, Hislop posits that one of the defining characteristics of successful innovating organizations is their effective cultivation, use and support for organizational communities of practice (Hislop, 2003). Since the original definition of CoP was that they were informal, organic, self-organizing and resistant to managerial interventions. How, then, can an organization go about utilizing this social structure to achieve its goals and priorities? 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).

There are several things an organization can do to create and support effective Communities of Practice. First, potential communities can be identified that support the organization's strategic direction (Wenger and Snyder, 2000). Organizations can intentionally set up communities based on needs and challenges existing in the organization. Potential members can be interviewed and selected based on their expertise and knowledge. It is also very important to define the CoP's role. If the members do not understand why they are there and how their particular expertise supports the CoP, they will not fully support and participate in it (Wenger and Snyder, 2000). By understanding what knowledge is needed to successfully

implement a new technology, an organization could encourage appropriate individuals to form a CoP as well as set outcome expectations and measure success (Wenger et al., 2002).

Secondly, organizations need to provide a supportive infrastructure for the CoP. Because CoP are informal social structures without budgets or formal departmental structures, organizations must intentionally invest time and money in nurturing and supporting them. Organizations should provide official sponsors for the CoP whose job is to remove obstacles, clear road blocks, and provide resources (Wenger and Snyder, 2000). Lastly, it is important for organizations to measure the outcomes of the CoP in order to legitimize their value (Wenger and Snyder, 2000). Since Communities of Practice are organic, informal structures whose outcome is knowledge and innovation, it is difficult to measure value in traditional ways. One way to assess the value of a CoP is to listen to the members' stories and learn how the CoP has improved processes, members productivity, or the diffusion of a new technology (Wenger and Snyder, 2000). If the CoP is not found to be of value in the organization, over time, it will be neglected and eventually, dissolve.

One of the more interesting aspects of Communities of Practice in this research is membership 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. They would want these people to be open to change and have a basic knowledge of the processes that will be affected by the new technology. This research will explore how social network analysis could be utilized to identify individuals in an organization with the social capital necessary to meet those objectives. An organization could then leverage the power and prestige of those individuals by nurturing a CoP that supports the new technology implementation.

## 2.6 Summary

Social network analysis focuses on relationships and how understanding those relationships can help an organization manage change, implement new technologies, be more innovative, achieve strategic initiatives, and ultimately, be more successful. Social network analysis research implies a link between an organization's social network and performance.

Organizations can use SNA as a resource to achieving their strategic objectives and mission. For an organization to be successful, they must continually adapt to new markets, diffuse innovation across the enterprise, improve productivity and implement strategic initiatives. The success of these actions requires the diffusion of innovations through effective communication channels. By understanding who is central in the organization, the organization identifies who has social capital, who has advantages in the exchange network, which relationships are critical for obtaining information and solving problems, who has access to the most efficient communication channels and who has influence over others in the adoption of innovations (Borgatti and Everett, 2005, Burt, 1987).

This centrality and social capital can then be leveraged to streamline communication flow, disseminate information quicker, build collaborations among the right individuals and utilize expertise when and where needed. Cross and Parker assert, after looking at sixty-two organizations, that well-managed networks are integral to performance, learning, and innovation (Cross and Parker, 2004).

This chapter defined social capital, summarized how an organization can use social network analysis, specifically centrality measures, to identify individuals with high social capital, and how these measures have been and can be used in the information systems industry. The next chapter will review the literature on technology acceptance with a focus on social influence as a predictor of an individual's intent to use a new technology. Chapter three will also provide the conceptual framework for the two propositions of this research.

# 3. Technology Acceptance

> *"Organizations spend millions of dollars on new information systems in the hope that these systems will allow them to successfully compete in today's and tomorrow's marketplace" (Hirschheim, 2007: 204).*

The previous chapter provided an overview of pertinent literature in the areas of social capital, social network analysis, and Community of Practice. In order to understand how to use social capital to support the adoption of new technologies, it is important to better understand the literature on technology acceptance. This chapter will explore technology acceptance models as a means to predict individuals behavioral intention to use a new technology. Specifically, social influence as a predictor of technology adoption will be explored. This chapter will also provide the conceptual framework for the propositions of this research.

## 3.1 Introduction

Technology acceptance has been and will continue to be a popular research topic for Information Systems researchers. As long as organizations continue to spend millions of dollars on new information technologies, researchers will continue to look for ways to improve adoption and usage rates. Higher education organizations are no different from any other organization. They continue to look to information technologies as a means for improving their position in the marketplace.

Researchers use a variety of technology acceptance models to study why and how individuals adopt new technologies (Venkatesh et al., 2003). These models aim to help organizations implement new technologies more successfully as well as manage existing IT resources (Taylor and Todd, 1995). This chapter will summarize how technology acceptance can be predicted and provide an overview of the most popular model, the Technology Acceptance Model (TAM). It will then provide an in-depth review of a newer model, the Unified Theory of Acceptance and Use of Technology (UTAUT) model including its strengths and weaknesses. In

particular, this chapter will focus on the social influence aspect of the UTAUT model and how the model could be used in conjunction with social capital as measured through social network analysis.

This chapter will include a summary of how existing research integrates technology acceptance and social factors. This summary will outline the need for further research in this area and how technology acceptance models, the UTAUT model specifically, can be used in practice. Chapter two contained a review of the literature on the use of social capital to support technology implementations and found in a scarcity of research in this area. This chapter will propose a conceptual framework that addresses this gap in the literature and proposes an innovative way to improving technology acceptance in an organization.

## 3.2 Background

There are numerous theories and models that information systems researchers use to help predict and explain how and why individuals adopt and use new technologies (Venkatesh et al., 2003). Technology acceptance models focus on an individual's intention to use a new technology as the predictor of usage and technology adoption (Davis, 1989, Davis et al., 1989, Venkatesh et al., 2003). This section provides an overview of the research being done in technology acceptance models.

The foundational theory supporting "intention to use" as a predictor of usage comes from social psychology's Theory of Reasoned Action (TRA) and its extension, the Theory of Planned Behavior (TPB) (Taylor and Todd, 1995). These theories have been used to predict a variety of human behaviors including technology acceptance and adoption (Venkatesh et al., 2003). Davis et al. (1989) state that according to TRA, a personal performance of a specified behavior is determined by his Behavioral Intention (BI) to perform the behavior, and BI is jointly determined by the person's attitude (A) and subjective norm (SN) concerning the behavior in question (BI = A + SN). This means that the strength of a person's intention to perform a behavior is the sum of their positive or negative feelings towards that

behavior plus their perception of how people who are important to him think he should or should not perform the behavior (Davis et al., 1989).

TPB adds Perceived Behavioral Control to Attitude and Subjective Norm as the core determinants of behavioral intention (Venkatesh et al., 2003). TPB accounts for conditions where individuals do not have complete control over their situation (Taylor and Todd, 1995). In Information System research, perceived behavioral control relates to the perceptions of internal and external constraints on behavior such as mandatory usage of a new technology in the workplace.

A basic assumption of these technology acceptance models is that an individual's intention to use a new technology is a strong predictor of their actual usage (Davis et al., 1989, Yi et al., 2006, Venkatesh et al., 2003, Han et al., 2004, Jackson et al., 1997, Taylor and Todd, 1995). TRA and TPB are foundational theories of the Technology Acceptance Model (TAM) and the Unified Theory of Acceptance and Use of Technology Model (UTAUT) which also adopt the assumption that intention is a major influence on behavior.

The ability to predict behavior is an important concept to this research. The scope of this study does not provide the time and resources necessary for in-depth, longitudinal studies that explore both intention and actual usage of new technologies. Therefore, this research will rely on the established theories and make the assumption that intention is an accurate predictor of usage (Yi et al., 2006). The next section looks at one of the most commonly used models, the Technology Acceptance Model.

## 3.3 Technology Acceptance Model

The Technology Acceptance Model (TAM) draws from both TRA and TPB and has become one of the most influential and widely used models in information system research over the past two decades (Legris et al., 2003, Lee et al., 2003, Benbasat and Barki, 2007). TAM was developed by Fred D. Davis as part of his doctoral research in 1986. Since that time, TAM publications have been estimated to take up

about 10% of information system journal space (Hirschheim, 2007) and is one of the most frequently cited papers in IS research with 700-1000 citations (Benbasat and Barki, 2007, Bagozzi, 2007, Venkatesh et al., 2007). For instance, TAM was recently the focus of a special issue of the Journal of the Association of Information Systems in April 2007. TAM is also one of the foundation models used by Venkatesh et al. (2003) when developing the UTAUT model.

TAM builds on TRA and tailors it to the IS context. It is made up of two main theoretical constructs, Perceived Usefulness (PU) and Perceived Ease of Use (PEU). Perceived usefulness is defined as (Davis, 1989: 320) "the degree to which a person believes that using a particular system would enhance his or her job performance." People generally want to perform better in their job, and to the extent they perceive a new technology will improve their performance and then, the more useful they will find it (Davis, 1989, Davis et al., 1989).

Perceived Ease of Use is defined as "the degree to which a person believes that using a particular system would be free of effort" (Davis, 1989: 320). Even if an individual believes a new technology is hard to use, he may determine that the effort of learning to use the system outweighs the benefits to his job performance (Davis et al., 1989). Research has found when applying TAM to many types of technologies and organizational situations that PU is a very influential belief and significantly predicts usage and that PEU precedes an individual's perception of PU and an important determinant of use in its own right (Benbasat and Barki, 2007, Venkatesh et al., 2003).

As illustrated in Figure 3.1, TAM includes attitude as a construct in determining behavioral intention to use a new technology (Davis et al., 1989). Attitude links TAM back to its foundations in the TRA model and illustrates that people will intend to behave a certain way if they believe the result to be positive. The figure does a nice job of illustrating that BI is the major determinant of usage and that people's intentions are determined by both PU and PEU (Davis et al., 1989).

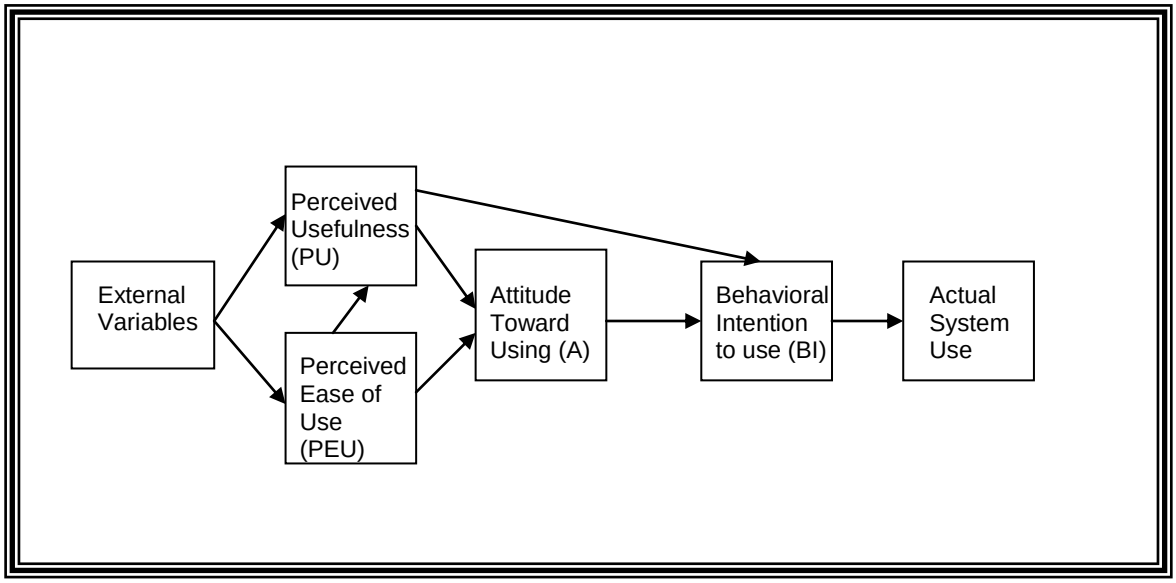


Figure 3.1: Technology Acceptance Model (Davis et al., 1989: 985)

The use of TAM over the past twenty years has been extensive. There have been a number of recent studies summarizing TAM research, including Lee et al. (2003) who summarized one hundred and one articles by leading IS journals and conferences, Schepers and Wetzels (2007) summarized sixty-three studies, Ma and Liu (2004) looked at twenty-six studies, King and He (2006) reviewed eighty-eight and Legris et al. (2003) summarized twenty-two studies. These summaries do a good job of outlining the use of TAM over the years to include how TAM has been applied to different technologies (word processors, e-mail, spreadsheets, the World Wide Web, Enterprise Resource Planning systems) under different situations (developing countries, non-profits) with different control factors (gender, culture, experience, blue collar workers, mandatory usage), and with different subjects (students, knowledge workers) (Lee et al., 2003, Zhang and Gutierrez, 2005, Musa et al., 2006, Rawstorne et al., 2000, Mather et al., 2002, Ma and Liu, 2004).

TAM has been expanded to include a variety of determinants from social norms and job requirements (Lucas and Spitler, 1999), communication and training (Amoako-Gyampah and Salam, 2004), training and support (Igbaria et al., 1997), to prior usage (Jackson et al., 1997). TAM has also been modified to include additional theories and research methods such as the Theory of Self-Identity, Theory of Planned Behavior and the Innovation Diffusion Theory (Yi et al., 2006, Lee et al., 2006), Uses and Gratifications theory (Mei-ling Luo et al., 2006), social network

analysis (Zack, 2000) and case study research (Behrens et al., 2005). Researchers have both validated (Lee et al., 2003, Adams et al., 1992) and invalidated the TAM model (Lucas and Spitler, 1999, Amoako-Gyampah and Salam, 2004, Igbaria et al., 1997).

### 3.3.1 Meta-analysis

Both quantitative and qualitative meta-analysis, as recently as Schepers and Wetzels (2007) study, has found the original TAM to be one of the most effective and efficient models available for measuring behavioral intention (Legris et al., 2003, Schepers and Wetzels, 2007, Ma and Liu, 2004, Lee et al., 2003, King and He, 2006).

One interesting finding by several of the summary literature articles was that the correlation between PU and BI is strong, the correlation between PU and PEU is strong, but the correlation between PEU and BI is weak (Lee et al., 2003, Ma and Liu, 2004). If Perceived Ease of Use minimally influences an individual's acceptance, yet significantly influences Perceived Usefulness, then the major emphasis of the TAM model looks to be PU and the relationship between PEU and PU cannot be ignored (Ma and Liu, 2004, King and He, 2006). This finding is important to both researchers and managers in that if only one construct can be used, PU would be the most important. Also, it is important, when implementing a new technology to take into account an individual's perceived ease of use when trying to influence their perceived usefulness.

Another commonality among the summary papers was their look at additional constructs other than those included in the original TAM model. These researchers found that subjective norm, type of user (student vs. non-student), type of technology (i.e. business application vs. internet), and culture (western vs. non-western), may be important moderators to technology acceptance (King and He, 2006, Schepers and Wetzels, 2007). The exclusion of these constructs may indicate a weakness of the TAM model.

Lee et al.'s (2003) research, as well as the April 2007 issue of the Journal of the Association for Information Systems, outline a number of additional weaknesses in the Technology Acceptance Model. One being that researchers have spent too much effort incrementally replicating TAM with minor adjustments (Lee et al., 2003, Benbasat and Barki, 2007). Others feel that TAM has been over used and used inappropriately at the group or organizational level instead of the individual context in which it was developed (Lee et al., 2003, Lucas et al., 2007). Some researchers also feel it is too difficult to put into practice so that management cannot use it to implement new technologies (Lucas et al., 2007, Lee et al., 2003).

Still others question the research methods and the use of surveys to determine usage behaviors (Lucas et al., 2007, Straub and Burton-Jones, 2007). Lastly, a number of researchers question the connection between technology acceptance and usage (Goodhue, 2007, Bagozzi, 2007, Schwarz and Chin, 2007). They advocate that additional research be conducted that focuses on explaining the relationship between PU and PEU.

Overall, TAM has provided value to the IS body of knowledge by its research rigor (Lee et al., 2003). TAM is built on a solid foundation (TRA) and has been effectively applied to a variety of situations in an effort to understand a major problem in the IS field (technology acceptance) (Goodhue, 2007). There are few other theories in the IS field that have made such an impact on our knowledge of IT acceptance (Lee et al., 2003).

Goodhue (2007: 220) put the use of TAM into perspective when he wrote, "like any good theory, TAM is a lens that lets us focus on one view of reality and see important relationships, but like any lens, it brings some things into focus and blurs others." Venkatesh et al. (2007: 268) state that, "technology adoption research is, in fact, "dead" in the most common current form – replication and minor extensions – but there are opportunities for future advances." Future areas of research could be to relook at the Theory of Planned Behavior and job satisfaction (Venkatesh et al., 2007, Benbasat and Barki, 2007). Lee et al. (2003: 768) concluded their meta-analysis by stating, "While there are still contradictory views on TAM research

considering the previous and current research trends, many exciting directions remain for making future discoveries."

TAM may have diverted researchers' attentions away from other areas (Benbasat and Barki, 2007), but it also provided IS research with a rigorous, parsimonious theory upon which to gain extensive knowledge in how to predict an individual's acceptance of technology (Lee et al., 2003, Ma and Liu, 2004). The UTAUT model is one attempt to address the limitations of the TAM model. The next section will look at UTAUT as a means to better predict technology acceptance.

## 3.4 Unified Theory of Acceptance and Use of Technology

The Unified Theory of Acceptance and Use of Technology (UTAUT) is a fairly new technology acceptance model developed by leading technology researchers. UTAUT looks at individual acceptance of technology (Ristola and Kesti, 2005, Zhang et al., 2004). UTAUT is an integration of eight previous IT acceptance models to include Theory of Reasoned Action (TRA), Technology Acceptance Model (TAM), Motivational model, Theory of Planned Behavior (TPB), Combined TAM-TPB, Model of PC Utilization, Innovation Diffusion Theory, and Social Cognitive Theory (Anderson and Schwager, 2004).

This research is most interested in the UTAUT model due to the fact that it has been proven to be more accurate than the other models, with the ability to predict technology acceptance 70% of the time (adjusted $R^2 = 70\%$). This predictability is much better than any of the eight models alone (Venkatesh et al., 2003). The UTAUT research model (see Figure 3.2) takes into account seven constructs that seem to be significant determinants of Behavioral Intention (BI) (Venkatesh et al., 2003). Based on UTAUT studies, four of these constructs appear to be direct determinants of user acceptance and usage behavior. They include:

- Performance Expectancy. The degree to which an individual believes that using the new technology will help him improve. This construct relates to

perceptions by individuals as to job-fit, usefulness, outcome expectations, and relative advantage in using the technology.

- Effort expectancy. The degree to which an individual thinks it will be easy to use the new system. Effort expectancy can also be viewed as the perceived complexity of the new technology. Gender, age and experience seem to impact this construct as well as whether or not the technology use is viewed as voluntary or mandatory.
- Social influence. The degree to which an individual perceives that important others believe he should use the system. Social influence, explicitly or implicitly, assumes that an individual's behavior is influenced by those around them and how others will view their use of the new technology. Terms such as subjective norm, social factors, and image have been used in previous models to measure social influence. Social influence varies in mandatory versus voluntary settings. Social influence looks at compliance when acceptance is mandatory and at influence when acceptance is voluntary.
- Facilitating conditions. The degree to which an individual believes that an organizational and technical infrastructure exists to support their use of the system. This construct takes into account how well the organization has removed barriers to use and how compatible the technology is with the existing environment. Venkatesh found that facilitating conditions does not predict behavioral intention when performance expectancy and effort expectancy are used. It does, however, have a direct influence on usage. This concept is illustrated in Figure 3.2.

Four additional criteria are labeled as key moderators or significant moderating influences on behavioral intention. These moderators impact each of the above constructs in different ways.

- Gender is shown to influence performance expectancy, effort expectancy and social influence. For instance men seem to be more likely to believe that technology will improve performance, be easy to use, and be important to those they admire.
- Age has been shown to influence all four constructs listed above.

- Experience relates to the length of time an individual has used the new technology. UTAUT posits that experience influences effort expectancy, social influence and facilitating conditions.
- Voluntariness of use refers to whether or not adoption and use of the new technology is mandated in the organization or voluntary. This moderator only seems to be a significant social influence in the early stages of technology adoption when the technology is mandated and others have the ability to reward or punish an individual for not using the technology

The UTAUT model measures three additional constructs that have not been found to be significant determinants in predicting behavioral intention (Venkatesh et al., 2003). These include:

- Attitude, in this model, intends to look at an individual's overall emotional reaction to using the new technology. Venkatesh et al. (2003) found attitude to be non-significant due to the effect being captured by performance expectancy and effort expectancy.
- Anxiety reflects an individual's expected stress in using the new technology. Venkatesh et al. (2003) found computer anxiety to be non-significant due to the effect being captured by effort expectancy.
- Self-Efficacy relates to an individual's self-confidence in their ability to use technology to do their job. Venkatesh et al. (2003) also found computer self-efficacy to be non-significant due to the effect being captured by effort expectancy.

The last piece of the UTAUT model theorizes that behavioral intention will have a significant positive influence on technology usage (Venkatesh et al., 2003) This theory is consistent with all of the underlying theories upon which it is built.

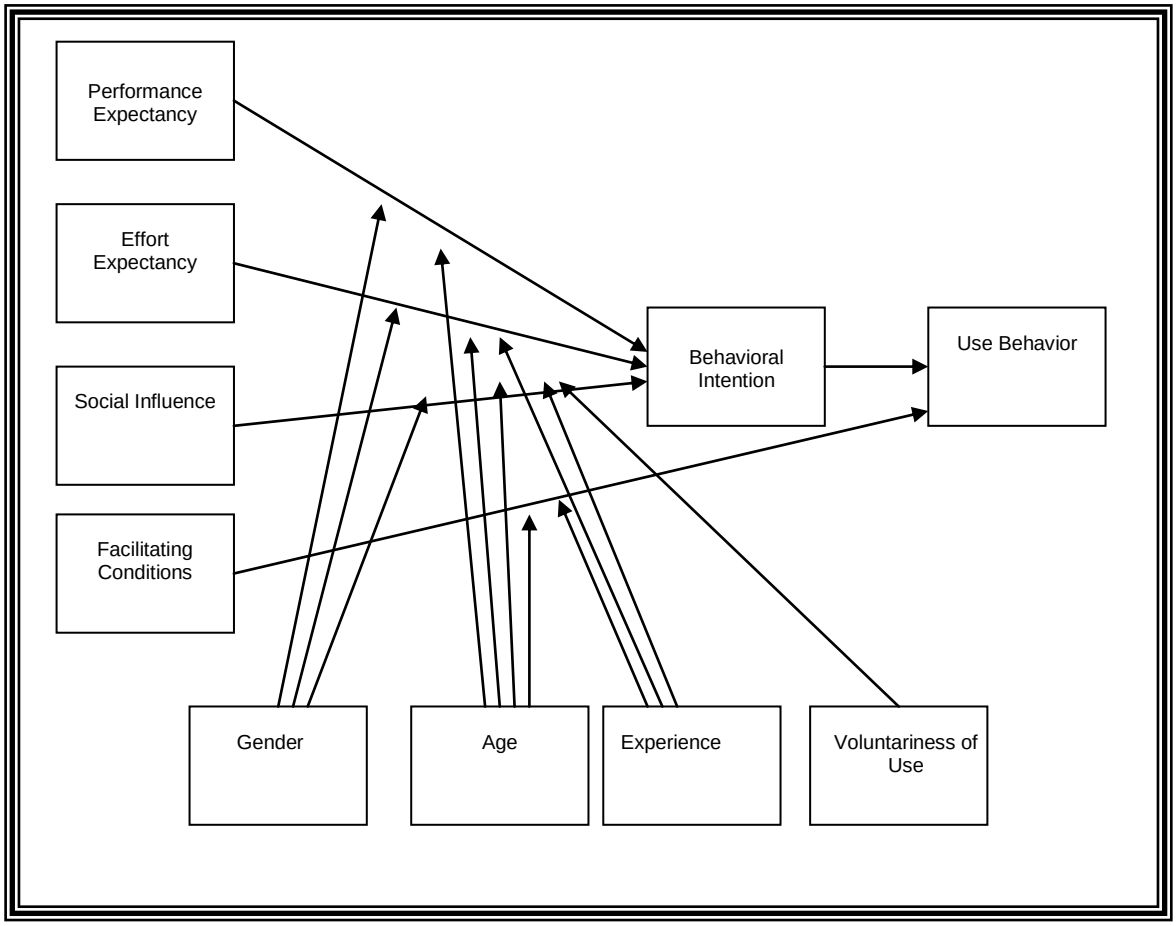


Figure 3.2. UTAUT Model (Venkatesh et al., 2003: 447)

As a sign of model acceptance and maturity, similar to TAM, researchers are now in the process of both validating and expanding on the UTAUT model. A literature review resulted in 20 studies that utilized the UTAUT model in their research. Table 3.1 summarizes these studies and is located later in this chapter.

The following examples illustrate the variety of work being done utilizing the UTAUT model. Schaper and Pervan applied the UTAUT model in combination with the technology acceptance framework proposed by Chau and Hu in 2002 to do both qualitative and quantitative research on non-profit health care organizations (Schaper and Pervan, 2005, Schaper and Pervan, 2007). Rosen (2005), in his doctoral research, modified the UTAUT model by integrating the Personal Innovativeness in the Domain of Information Technology (PIIT) to measure technology adoption.

Ristola and Kesti (2005) looked at widening the scope of the UTAUT model to include mobile-commerce and mobile-environment technology adoption, specifically looking at facilitating conditions over time. Knutsen (2005), due to the prospect of a very small sample size, modified the UTAUT model to include only the latent variables and individual difference variables most relevant to his study. This research also incorporated qualitative methods to look at behavioral intention to use new mobile services. Knutsen's (2005) research found that attitudes towards these services were fragile and changed based on first experiences and impressions. Wright's (2005) research applied the UTAUT model to the complex health care industry looking at adoption of an electronic health record system where physicians were both the purchasers and adopters of the technology.

As described in the above examples, validation of the UTAUT model has been done on a variety of technologies in a variety of settings. Of the five studies that did not modify UTAUT, all found the model to be useful in looking at the acceptance of a particular technology in a unique context (Anderson et al., 2006, Bandyopadhyay and Fraccastoro, 2007, Carlsson et al., 2006, Louho et al., 2006, Schaper and Pervan, 2007).

Of interest to this research is that four of the five did not find a significant relationship between social influence and behavioral intention. The significant correlation occurred when looking at culture outside of the United States when evaluating the acceptance of prepayment metering systems (Bandyopadhyay and Fraccastoro, 2007). This finding confirmed Bandyopadhyay and Fraccastoro's (2007) belief that culture is a strong influence on technology acceptance and the social pressure for a person to change their behavior varies by culture. The fact that four of the five did not find a significant correlation between SI and BI is justification for the need for further research in this area to strengthen the ability to look at social influence as a factor in acceptance of new technologies.

Fifteen of the studies modified UTAUT in some way in an effort to improve the model or better address their research question. These researchers incorporated theories surrounding culture, leadership, personality traits and personal innovativeness in the attempt to improve the model. In reference to social influence,

five of the studies were qualitative in nature that resulted in expanded looks at social influence to include peer influence, peer pressure, and customer influence (Garfield, 2005, Lin et al., 2004, Ruenis and Santema, 2005, Wang and Yang, 2005, Wang et al., 2006).

Six of the modified UTAUT studies were quantitative studies. Of the six, four found a significant relationship (Al-Gahtani et al., 2007, Chang et al., 2007, Han et al., 2004, Neufeld et al., 2007, Rosen, 2005). These mixed results, again, justify the need for additional research and modification of the UTAUT model in order to better understand social influence's role in determining behavioral intention. The next section will outline the strengths and weaknesses of the UTAUT model in predicting behavioral intention to use a new technology.

### 3.4.1 Strengths and Limitations of UTAUT

The strength of the UTAUT model and why researchers use it, is its strong theoretical foundation, comprehensiveness, and the rigor that went into its development (Schaper and Pervan, 2005, Han et al., 2004). Venkatesh et al.'s original research found the UTAUT model explained up to 70% of variance (adjusted $R^2$) in usage intention where the other models accounted for between 17% and 53% (Han et al., 2004, Venkatesh et al., 2003).

Critics posit that the UTAUT model is a reincarnation of the Theory of Reasoned Action and Theory of Planned Behavior models (Benbasat and Barki, 2007). Others state the UTAUT model, even with forty-one independent variables for predicting intentions and at least eight independent variables for predicting behavior, omit important independent variables (Bagozzi, 2007). These researchers suggest a model that better conceptualizes system usage, looks at a broader user perspective, integrates longitudinal studies, and identify the causes of the beliefs inherent to adoption.

This research intends to address these limitations, specifically the beliefs inherent to adoption, by looking at how individual social capital can be used to support a technology implementation. Of particular interest is social influence, the exclusion

of which Legris et al. (2003) found to be a weakness of TAM. Their meta-analysis of TAM caused them to conclude that TAM is a useful model but has to be integrated into a broader one which would include variables related to both human and social change processes and the adoption of the innovation model. The inclusion of social influence as a determinant of technology acceptance is one way to address this weakness of TAM. However, as outlined in Table 3.1 and as will be described in the next section, social influence, even in the UTAUT model, has proven to provide inconsistent results as a predictor of behavioral intention.

## 3.5 Social Influence

This section will delve deeper into the need to further understand the relationship between social influence and technology acceptance. The social influence construct of UTAUT was derived from subjective norm used in TRA, TAM2, TPB and other theories upon which UTAUT was built (Venkatesh et al., 2003). Other terms such as social norms, social factors, and image have also been used to describe social factors that influence technology acceptance.

Psychology research has established that social context is an important determinant of intention (Schepers and Wetzels, 2007, Yi et al., 2006). The compliance effect posits that people choose to do something based on the opinions, suggestions, and desires of those who are important to them. Individuals will alter their intentions based on social pressure, especially when that pressure involves rewards (Venkatesh et al., 2003). Technology acceptance models label the compliance effect as subjective norm or social influence.

The internalization effect in social psychology posits that the opinions of important others affect an individual's perception or opinion. For technology acceptance models, the internalization effect asserts that an individual's perceived usefulness (PU) of a new technology could be determined or influenced by the opinions of important others (Yi et al., 2006, Schepers and Wetzels, 2007).

Many of UTAUT's foundational theories include a determinant related to social factors. The Theory of Reasoned Action, Theory of Planned Behavior, and expanded Technology Acceptance Model, TAM2, all have subjective norm as a core construct (Venkatesh et al., 2003, Yi et al., 2006). Subjective norm is defined as the person's perception that most people who are important to him think he should or should not perform the behavior in question (Venkatesh et al., 2003, Lee et al., 2006).

Additional technology acceptance research has taken into account the importance of social context surrounding technology implementation using a variety of terminology (Murphy and Chang, 2002). Zack and McKenney's 1995 research found that two similar groups adopted technology differently seemingly based on their unique social contexts (Zack and McKenney, 1995). In 2000, Zack linked technology acceptance and social networks in reviewing three research studies (Zack, 2000). He suggested, in reference to TAM, that by looking at how individuals who have accepted a technology are connected to others (by communication, work flow, formal structure, or friendship), may help predict that individual's attitude towards the technology. Attitudes are often associated with perceived use and perceived ease of use (Benbasat and Barki, 2007).

Other researchers use an image construct to predict usage (Agarwal and Prasad, 1997). TAM2 posited that perceived usefulness was influenced by subjective norm partially by altering image (Yi et al., 2006). Image is used in the Diffusion of Innovations model to measure how a new innovation impacts the social status of the individual (Moore and Benbasat, 1991). Professionals, in order to create or maintain a positive image in their social group, respond to social influences (Yi et al., 2006).

Whether using the term social influence, subjective norm, attitude, or image, this line of research posits that social networks play a primary role in determining an individual's intent to use a new technology (Murphy and Chang, 2002). It is not without its inconsistencies, however. In 2006, Lee et al. reviewed the literature on technology acceptance and social influence. They reviewed 14 research studies from the previous fifteen years that used a variety of theories (TAM, TPB, UTAUT, TRA, TAM II, Triandis) to look at social factors (social influence, social pressure or

social norm), all using the same measurement scales as subjective norm. The results of these studies were mixed with subjective norm being found significant in certain situations at different times (Lee et al., 2006, Schepers and Wetzels, 2007, Yang and Choi, 2001).

Researchers have found it to be very difficult to identify subjective norm versus attitude as effecting behavioral intention (Davis et al., 1989). For example, it is difficult to determine if individuals intend to use a new technology because they believe it will help them do their jobs or because others expect them to use it, i.e. the compliance effect. Kim et al. (2004: 3318) also summarized the inconsistent results in the relationship between social influence and technology use:

> *"Fulk (1993) found a positive relationship between SI and utilization behavior. Schmitz and Fulk (1991) found that individuals' communication technology use was predicted by communication network members' actual use. However, Davis et al (1989) found no significant relationship between social factors and usage behavior. Lewis, Agarwal, and Sambamurthy (2003) also found that perceived social influence from referent others had no significant influence on individual beliefs about usefulness."*

Venkatesh et al. (2003), in their original research when establishing the UTAUT model, evaluated the use of subjective norm, social factors and image as part of the eight foundational technology acceptance models and theories that went into developing UTAUT. They found social influence to have a complex yet significant relationship with behavioral intention (Venkatesh et al., 2003). Specifically, UTAUT validated previous research in that social influence seems to be most significant in mandatory rather than voluntary environments. This can be substantiated by the compliance effect where those with authority influence an individual's intent to use the new technology.

Second, UTAUT posited that gender and age would be factors in social influence (Venkatesh et al., 2003). Theory suggests that women tend to be more sensitive to

other peoples' opinions and therefore would be more disposed to be influenced by important others. Theory also suggests that as people get older, they are more likely to be influenced by others. Thirdly, social influence seemed to be mediated by experience. Individuals, during the early use of a new technology, seem to be more strongly influenced by social factors than later on during sustained usage (Venkatesh et al., 2003).

Therefore, the original UTAUT model posited a very complex relationship between social influence and behavioral intention in their hypothesis "the influence of social influence on behavioral intention will be moderated by gender, age, voluntariness and experience, such that the effect will be stronger for women, particularly older women, particularly in mandatory settings in the early stages of experience" (Venkatesh et al., 2003: 453). The results of their research supported this hypothesis.

Subsequent UTAUT researchers both validate and invalidate this finding (Table 3.1). Carlsson et al. (2006) for instance, in their study on the adoption rates of mobile devices and services found that the relationship between social influence and behavioral intention to not be significant in all cases. They found a positive relationship between the variables when social influence was alone as an independent variable but found that it was not significant when examining all constructs. The influence of social status was discovered partly through other factors (PE and Attitude) therefore, they could not use SI as explanation for BI (Carlsson et al., 2006). Louho et al. (2006) in their study of hybrid media applications and mobile services, also found social influence not to be a significant determinant of behavioral intention to use code reading applications. Although, this study was limited by a small sample size.

| Study (reference) | Sample Size/ Response Rate | Type of Technology | Modification to UTAUT | Social Influence Findings |
|---|---|---|---|---|
| (Al-Gahtani et al., 2007) | 722 | Desktop computers | Modified UTAUT:<br>Removed voluntariness<br>Replaced subjective norm for social influence | Significant |
| (Anderson et al., 2006) | 50<br>74% | Tablet PC | | Not significant |
| (Bandyopadhyay and Fraccastoro, 2007) | 502 | Prepayment Metering Systems | | Significant |
| (Carlsson et al., 2006) | 157<br>52.3% | Mobile devices/services | | Not significant |
| (Chang et al., 2007) | 115<br>82.14% | Clinical decision support system | Modified UTAUT | Marginally supported |
| (Garfield, 2005) | | Tablet PC | Longitudinal Qualitative field study | In meeting settings – intimidating or boasting<br>In non-meeting settings – enhanced image and helped initiate conversations |
| (Han et al., 2004) | 134<br>38% valuable response rate | Mobile medical information system | Modified UTAUT | Not significant |
| (Heerink et al., 2006) | 11 + 36 | Human robots | Adapted UTAUT interviews combined with Social Behavior Questionnaire | unknown |

| Study (reference) | Sample Size/ Response Rate | Type of Technology | Modification to UTAUT | Social Influence Findings |
|---|---|---|---|---|
| (Knutsen, 2005) | 38 | Mobile services | Modified UTAUT using only PE, EE, Attitude and Age | NA |
| (Lin et al., 2004) | 300 | Instant messaging | Modified by dividing social influence into peer influence and social influence | Peer pressure significant<br>Peer influence on BI moderated by SI |
| (Louho et al., 2006) | 19 | Hybrid media applications | | Not significant |
| (Neufeld et al., 2007) | 209<br>49.5% | Variety of enterprise systems | Combined with Charismatic Leadership Theory | Significant |
| (Park et al., 2007) | 221 | Mobile Communication in China | Modified attitude and usage of the internet questions | Significant |
| (Ruenis and Santema, 2005) | 14 | e-ordering system | Combine with managerial interventions – influence tactics | Peer influence strong, Role of 'gatekeepers' strong, Accounts Payable was a strong 'tool' to drive compliance |
| (Ristola and Kesti, 2005) | 39.8% of 610 | Mobile services | Modified UTAUT | unknown |
| (Rosen, 2005) | 120 | Problem solving software | Modified using Personal Innovativeness in the Domain of Information Technology (PIIT) | Not significant |
| (Schaper and Pervan, 2007) | 600 | Information and Communication Technologies (ICT) | | Not significant |

| Study (reference) | Sample Size/ Response Rate | Type of Technology | Modification to UTAUT | Social Influence Findings |
|---|---|---|---|---|
| (Venkatesh et al., 2003) | 215 & 133 | New technologies | Original | Significant |
| (Wang and Yang, 2005) | 196<br>28% | Online stocking (investing) | Modified to include personality traits Big Five Factors | Effect stronger for agreeableness with internet experience and conscientiousness with internet experience |
| (Wang et al., 2006) | 28 companies | Electronic Marketplaces | Case study using interviews based on UTAUT | Trend followers, Customer requests Other influences |
| (Wright, 2005) | 15 | Electronic Health Record | Qualitative interviews based on UTAUT | Not applicable |

Table 3.1 Summary of UTAUT Research and Social Influence

Using the UTAUT model to develop interview questions, Garfield researched user acceptance of Tablet PCs, specifically how the perceptions of others in meetings and outside of meetings would affect an individual's image (Garfield, 2005). Garfield found that the use of Tablet PCs enhanced an individual's image in certain situations and did not in other situations. In this qualitative study, social influence did have an impact on an individual's intent to use the technology, both positively and negatively.

Schaper and Pervan (2005) based their qualitative and quantitative research on a non-profit, community-based health care organization's adoption of a new IS infrastructure that included changes to hardware, software, data, and networks. They used interviews, observation, questionnaires, and documentation review in their longitudinal study. Their findings were that although social influence did not receive a high statistical score, qualitatively they found social influence to have an impact on IS use.

In researching physicians' acceptance of clinical decision support systems, Chang et al. (2007) used the modified UTAUT model and surveyed 140 physicians. The results of this research only marginally supported their hypothesis that social influence would positively affect the users' intention to use the clinical decision support system (Chang et al., 2007).

In a study that examined the acceptance and usage of instant messaging among college students in a non-work related context, Lin et al. (2004) validated the UTAUT model. Lin et al. separated social influence into peer influence and social influence where peer influence refers to friends as the referent group and social influence refers to others besides friends. The research hypothesizes that first, peer pressure will have effect on behavioral intention and second, that the effect of peer influence on behavioral intention will be moderated by social influence, such that the higher social influence will reduce the effect of peer influence were both supported (Lin et al., 2004).

Table 3.1 provides an overview of UTAUT research and the social influence findings. These studies and TAM research, in general, suggests that social influence

has a very complex relationship with technology acceptance. Although empirical evidence is not conclusive, theory suggests that social influence plays a significant role in behavioral intention to use technology. (Lee et al., 2006, Murphy and Chang, 2002). Given this strong theoretical foundation and the mixed results of previous research, it is important to continue looking at social influence in an effort to find a way to better predict technology acceptance (Yi et al., 2006).

The last two sections provided a summary of the UTAUT model and focused on the Social Influence construct in predicting technology adoption. The review of the literature supports the need for further research into improving the social influence construct of the UTAUT model. The next section discusses the relevance of this research to IS professional practice.

## 3.6 UTAUT in Practice

The UTAUT model has direct relevance to professional practice. The key benefit is that managers can use the UTAUT questionnaire in order to measure the likelihood that a new technology will be adopted and take preventative measures to improve acceptance (Anderson et al., 2006, Wixom and Todd, 2005). This tool helps project managers understand the strengths and weaknesses of their organization in relation to the different constructs allowing them to proactively prioritize, develop and implement interventions that their unique population may need in order to improve the technology implementation (Anderson et al., 2006).

One example might be that the facilitating conditions scores are very low which may indicate that users do not feel they have the support and training needed to effectively use the new technology. Another example may be that the Perceived Ease of Use score may be low indicating that targeted communication and training could help the end users feel more comfortable using the new tool and perhaps facilitate their acceptance and use of it.

The UTAUT model has been deployed in a number of industries attempting to improve the acceptance of a variety of technologies. Two studies, for example

looked at Tablet PCs in education, medical, publishing and retail (Anderson et al., 2006, Garfield, 2005). One study found that Performance Expectancy was the most important variable in user acceptance by faculty leading to the conclusion that an emphasis on the benefits faculty will receive when using a Tablet PC in marketing and training will improve adoption (Anderson et al., 2006). The other study outlined four ways the Tablet PC led to improved job performance in a variety of industries (Garfield, 2005). This study found that Tablets could potentially improve information exchange, allow workers to multi-task, help individuals become more organized, and help them display and analyze visual data more efficiently. These findings could directly and positively impact the bottom line of organizations.

Another example outlines how UTAUT can be used in the health care industry to improve information exchange. Schaper and Pervan (2004) employed UTAUT and surveyed occupational therapists on their utilization of information communication technologies (ICT). In an industry known for being reluctant to adopt new technologies, they found effort expectancy and compatibility to be significant influences on occupational therapists intention to use ICT (Schaper and Pervan, 2007). This research also found social influence to be insignificant. These findings assist project managers and health care leaders develop effective strategies for implementing ICT in their facilities.

The use of UTAUT has been proven effective in countries outside of the US and western Europe. In a study in China looking at mobile communication, a very fast moving industry, researchers found social influence and PE as the main factors explaining Chinese users' attitude toward mobile technology adoption (Park et al., 2007). Specifically, they found that males were most influenced by performance expectancy and women by effort expectancy. Businesses could then market their product to males differently than females, emphasizing functionality for males and ease of use for females.

Bandyopadhyay and Fraccastoro (2007) utilized UTAUT in their research in an attempt to measure user acceptance of Prepayment Metering Systems in India. Prepayment Metering Systems are an emerging technology in many countries including the United States. A better understanding of what may facilitate large

scale user acceptance of the system could potentially facilitate adoption of the metering system in thousands of locations around the world. The success rate of the installations would potentially be higher in that IT managers could design and implement strategies that would facilitate usage. In the current study, emphasis is placed on usefulness and social pressures.

Lastly, UTAUT can improve the marketing of a new product or service. Any of the above examples apply here. For instance, a sales organization which understands the cultural differences in adopting technology between the West and India will market their product differently. Another example is the online stocking industry. Online investment is easy to use and convenient. However, individuals have been slow to adopt the service. Wang and Yang (2005) used UTAUT to provide online stock broker companies information on how individuals with different personality traits adopt these services. They concluded by offering suggestions on different marketing strategies that could improve adoption.

This section outlined how the UTAUT model has been used in practice to predict an individual's behavioral intention to use a new technology. The last two sections summarized how UTAUT has been used in research and practice which informs and supports the use of the model in this research. The next section summarizes the literature review and defines a conceptual framework for this research which will address some of the gaps in the literature.

## 3.7 Conceptual Framework

This chapter began with the assumption that it is important to higher education organizations to successfully implement new technologies that will help them compete in the marketplace. Therefore, it would be very beneficial to better understand and predict the acceptance or adoption of the new technologies, diagnose why technologies are not adopted, and finally, figure out ways to more successfully implement new information systems (Davis et al., 1989).

Bringing a new technology application into an organization is a good example of a strategic change. Identifying and mobilizing change agents who have social capital in the organization can help the change process as central individuals persuade and assist those close to them (Frank et al., 2004, Steier and Greenwood, 2000). New technologies often require individuals to do their job differently, to learn new skills, and to work with different people. Therefore, it can be concluded that by understanding the organization's informal social network and the social capital residing there, can help that organization successfully manage the change associated with a new technology implementation.

Also, there is agreement among a number of researchers that it is important to incorporate an individual's social context when introducing new technologies and innovations into an organization (Zack and McKenney, 1995, Legris et al., 2003, Schepers and Wetzels, 2007, Yi et al., 2006). The Diffusion of Innovation theory incorporates social structure as a key component to problem solving and knowledge creation (Rogers, 1995). Technology implementations require a social structure with effective communication channels for the innovation to be diffused into the organization. In addition to identifying individuals with social capital to serve as change agents, social network analysis also serves as a way for organizations to understand their social structure as well as its existing communication channels.

The social structures of Communities of Practice have been found to have excellent communication channels. Rogers' Diffusion of Innovation theory emphasizes the need for communication to effectively diffuse a new technology into an organization as well as a social structure by which the communication travels. A CoP, then, could serve as a powerful social structure upon which to communicate information and diffuse a new technology into an organization.

The conceptual framework of this research, then, will focus on better understanding the social network of relationships in an organization and how social capital can support technology implementations. There are two ways that this research will attempt to address the gap in the literature. First, by utilizing social capital measures in an attempt to better predict behavioral intention in the UTAUT model and second, through the use of social network analysis to identify members with a high degree of

social capital to inform membership in a Communities of Practice that would be encouraged to support the diffusion of a technology into an organization.

One way to ensure the success of a technology implementation is to predict adoption and identify variables that may be inhibiting people from using a new technology. Researchers have used technology acceptance models to measure these variables and assess individual behavioral intentions to use new information systems. Behavioral intentions have been found to be a good predictor of actual usage. This chapter summarized three technology acceptance models that evolved from each other, TRA, TAM and UTAUT, and found that none of them are perfect. The social influence aspect of these models, in particular the UTAUT model, has been found to be important, complex, and inconsistent. Theory suggests that social factors influence intention to use technology, however empirical evidence has been mixed. The literature review, therefore, provides support for the need to research a means to measure social influence in order to better predict an individual's behavioral intention to use a new technology.

The UTAUT model will be used in this research due to its strong theoretical foundation, comprehensiveness, and high explanatory power. Further, a gap in the literature exists, as outlined in chapter two, section 2.4.2, in that no literature was found that incorporates social network analysis into the use of the UTAUT model. However, the use of SNA to measure social influence seems to be a legitimate research focus (Vidgen et al., 2007).

The Social Influence construct of the UTAUT model and the concept of influence in social network analysis is similar in that each measures the influence of others on an individual's attitudes, opinions and actions. Incorporating social network influence measures into the UTAUT model may be a way to better predict an individual's behavioral intention to adopt a new technology. Therefore, social network influence measures will be incorporated into the UTAUT model to better predict an individual's behavioral intention to adopt a new technology.

Another use of social network analysis could be to identify individuals with social capital to support an organization's technology implementation. Chapter two

outlined the concept of diffusion of innovation as one means to explain how a new technology is diffused into an organization. Communities of Practice were suggested as a social structure that could be used to facilitate this diffusion based on the assumption that new knowledge is generated through active participation in communities. Social channels are needed to communicate and diffuse the technology innovation into the organization.

Social network analysis measures could provide project leaders with insight into their information networks social channels and identify individuals with high social capital, those with power and prestige in the organization. Project leaders can leverage the social capital of these central individuals by inviting them to join a Community of Practice created to support an enterprise-wide technology implementation. This CoP, if nurtured and supported effectively, will ensure the successful diffusion of the technology innovation throughout the organization. As outlined in chapter two, this CoP, by its very nature, will develop practical expertise as relates to the technology implementation, understand appropriate communication messages and channels, be able to provide insights into training and documentation needs, be open to change, creatively solve problems, and develop a strong sense of identity and ownership over the successful diffusion of the technology into the organization.

Figure 3.3 outlines this conceptual framework and shows the relationship between an organization's use of social network analysis to understand their informal relationships and network structure and the use of SNA measures to support an enterprise wide technology implementation. The conceptual framework modifies Venketesh et al.'s (2003) UTAUT model in an effort to strengthen the social influence construct through the use of social network influence measures. The framework goes on to incorporate social network centrality measures by identifying individuals with high social capital to inform membership in a CoP whose role would be to support a technology implementation. These two propositions aim to address the gaps in the literature though the use of social network analysis to identify social capital to support technology adoption and implementation.

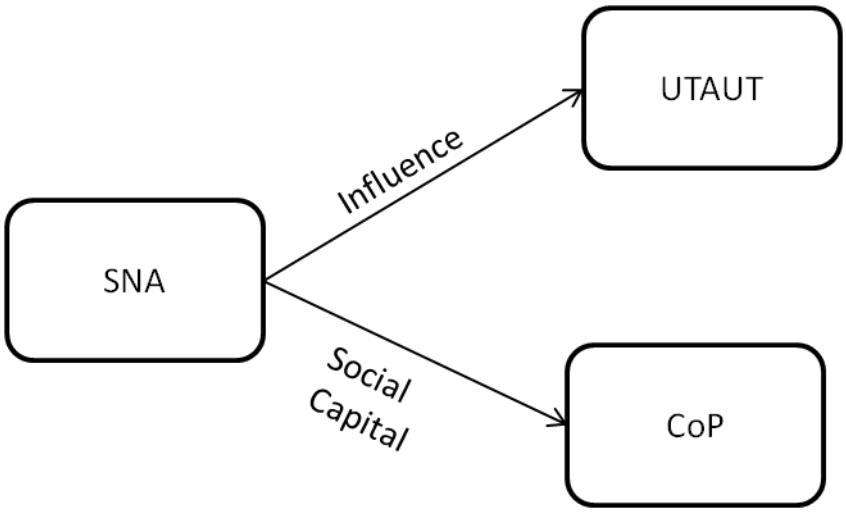


Figure 3.3: Conceptual Framework

## 3.8 Summary

This chapter explored the use of technology acceptance models to support technology implementation by predicting an individual's behavioral intention to use a new technology. Specifically, social influence was explored as one determinant of adoption that is both important yet difficult to measure. The chapter concluded by outlining the conceptual framework for the propositions of this research and the use of social network analysis in relationship to the UTAUT technology acceptance model, as well as to inform membership in a CoP.

The next chapter will outline the purpose, approach, epistemology, and design of this research. It will clearly define the cases, data collection methods, and analysis methods. The chapter will conclude with a clear definition of the propositions and hypotheses of this research.

# 4. Research Methods and Design

> *"Taking a social structure approach to defining organizational forms also enables us to account for social influences on communication and information technology use." (Zack, 2000: 2).*

The research methods chapter defines the purpose, approach and design of a research project. This chapter opens with a summary of an area of concern in higher education and how this research addresses that concern. Due to the complexity of understanding information systems in a social network context, a hybrid research paradigm approach is proposed containing elements of both positivist and interpretive ways of knowing. These approaches will be implemented through three field experiments and an action case. This approach will be explained and supported by the literature. The research design was determined by the two research propositions. The data collection methods and analysis techniques used to support the design will be explained in conjunction with a description of the three higher education case organizations.

## 4.1 Research Purpose

Higher education institutions, like most other types of organizations, have looked to implement information technology to meet their strategic goals and remain competitive in a fast-paced, market-driven environment. The purpose of this research is to explore the use of social capital to support enterprise-wide technology implementations in a higher education context in an effort to improve this success rate. As outlined in the Conceptual Framework section of Chapter three, one aspect of the research looks at the use of social network analysis to predict social influence in the UTAUT model rather than the existing individual perceptions that make up the social influence construct. The second aspect of the research identifies individuals with social capital to inform membership of a Community of Practice to support a technology implementation through the diffusion of the technology innovation. The research explores how an organization, by understanding their

informal social network, can leverage the power and prestige associated with social capital, to support a technology implementation. The overall purpose of this research is to help higher education organizations improve acceptance, and ultimately use, when implementing new information technologies.

This research expects to contribute to both theory and practice. The study is new and innovative in that there has been very little work done integrating social network analysis and social capital with technology acceptance. The analysis of the UTAUT model on administrative staff in three HEO's will contribute to technology acceptance theory. The explorations into the use of social capital to support technology implementations will contribute to practice by providing practical tools for IS professionals. The next section will explore the research paradigms needed to conduct this research.

## 4.2 Research Methodology

### 4.2.1 Ontology and Epistemology

This section outlines the three important concepts or assumptions necessary to understanding a research project: ontology, epistemology, and methodology. First, ontology refers to 'what we know', what exists, and the form and nature of our reality (Punch, 1998, Scott and Usher, 1996). There are two extreme views of the world, realism and nominalism. Realists look at knowledge as objective and assume the empirical world is objective and independent of humans. Nominalists are more subjective and feel the empirical world exists through the action of humans (Orlikowski and Baroudi, 1991). These are two extreme positions and, in reality, research falls somewhere on the continuum of philosophies.

Where ontology is concerned with the nature of reality, epistemology refers to how we know what we know, how we make value judgments, or how we know what is true. Epistemology is concerned with the question of what is truly knowledge and what is the relationship between what is known and who knows it (Punch, 1998, Orlikowski and Baroudi, 1991). It is important to understand the epistemological

viewpoint of any research model in order to understand the research outcomes and how the researcher came to her conclusions.

From a research perspective, how people look at the world falls on a continuum between positivist and interpretive points of view (Braa and Vidgen, 1999). A positivist approach to research is logical, empirical and value-free (Susman and Evered, 1978). The researcher is an observer, acts as an outsider to the process, and tries not to intervene in the situation (Braa and Vidgen, 1999). A positivist creates new knowledge only when it can be verified through measurement and observation (Domholdt, 2005). Positivist research usually starts with a theory or predetermined relationship which is then investigated using structured instruments such as surveys or laboratory experiments (Orlikowski and Baroudi, 1991). To be valid, the results must be replicable and applied universally. Quantitative research stems from the positivist perspective where information is expressed as numbers and can be quantified (Punch, 1998). Quantitative research analyzes data as empirical information in numerical form in order to gain an understanding of a situation that can be, by extension, applied to universal situations. Quantitative research seeks to prove causal relationships in order to predict future situations based on particular relationships or variables (Punch, 1998).

The interpretivist approach, on the other hand, assumes individuals create their own subjective reality as they interact in their environment (Orlikowski and Baroudi, 1991). Interpretive research attempts to understand the world from the inside, one situation at a time. The interpretive epistemology is that reality is very much a situational, social construct. New knowledge is generated when there is an understanding of the complex environment and information is gained about a particular situation at a specific time. The aim of interpretive research is not to gain a universal truth, but to better understand a unique, complex human process in a particular situation that can then be used to inform other situations (Baskerville and Wood-Harper, 1996, Orlikowski and Baroudi, 1991). Interpretive research is most often qualitative in nature looking at empirical information about our environment that is not in numerical form (Punch, 1998). This information is usually in the form of words such as interview transcripts, recordings, or observational records.

Positivist research has long been the dominant style in the social sciences, including Information Systems research (Susman and Evered, 1978). Orlikowski and Baroudi (1991) reviewed 155 IS research articles written between 1983 and 1988. They found that 96.8% were from a positivist perspective, 3.2% were from an interpretive perspective, and 3.2% utilized mixed research methods. A number of IS researchers have expressed concern with the dominance of positivist research and the lack of interpretive and mixed method research (Evered and Louis, 1981, Orlikowski and Baroudi, 1991, Milward and Provan, 1998, Lee, 1991, Stone, 1990, Coghlan, 2004).

The study of information systems is much more than the development of computer systems. IS research is concerned with technology, psychology, economics and the integration of technology and organizations. The implementation of a new technology is a complex phenomenon in that it includes technology, people, society, and an environment that is constantly changing. It is comparable to other management and organizational research containing the same complex, real world challenges (Mingers, 2001, Galliers, 1993). Practitioners are finding traditional IS research to be irrelevant and unreadable (Susman and Evered, 1978, Coghlan, 2004). Positivist research does not address the needs or provide solutions that can be applied to practice (Galliers, 1993). Evered and Louis, as far back as 1981, wrote that IS research solely conducted from a positivist point of view produces "feeble results - results that are precise but irrelevant" (Evered and Louis, 1981: 393).

Positivism is thought to be deficient by interpretivists as a means of understanding social situations. The very idea of causation is a positivist perspective, where interpretivists feel the world is too complex and dynamic to look for a causal relationship (Punch, 1998). Susman and Evered (1978) in their seminal paper on Action Research, posited that positivism is deficient in generating knowledge for organizations who need to solve unique problems due to a number of reasons including the positivist treatment of people as objects of inquiry, that history is not taken into account, and that the methods are values neutral. The interpretive approach, as Lee (1991 347) states, "maintains that the methods of natural science are inadequate to the study of social reality. This school of thought takes the position that people, and the physical and social artifacts that they create, are fundamentally different from the physical reality examined by natural science."

### 4.2.2 Hybrid Approach

The traditional view towards epistemology has been that research is conducted from a single approach, either positivist or interpretive. Mingers (2001: 240-241) wrote that traditionally, research "paradigms are based on mutual exclusivity and contradictory assumptions and individual researchers do, or should, follow a single paradigm." Again, due to the fact that IS research takes place in an organization context, a single epistemological approach has been questioned. Evered and Louis (1981: 393) wrote, "Our ability to grasp the breadth, depth, and richness of organizational life is hampered by allegiance to a single mode of inquiry". Orlikowski and Baroudi (1991: 7) also wrote of their concerns with a single approach,

> *"An exclusive view is always only a partial view, and the dominance of positivism, by not acknowledging the legitimacy of other research traditions, has limited what aspects of information systems phenomena we have studied, and how we have studied them. This has implications not only for the development of theory and our understanding of information systems phenomena, but also for the practice of information systems work."*

There is evidence that researchers are trying to address this issue by using a combination of interpretive and positive methodologies in order to better understand and explain complex phenomenon (Braa and Vidgen, 1999, Trauth and Jessup, 2000). Mingers (2001) reviewed six journals between 1993 and 1998 for multiple methods and found that two thirds of the articles contained empirical research, 80% used surveys, interviews, experiments, or case studies and 13% of the empirical research used more than one research method.

Mingers (2001) outlined three types of multi-method research approaches. The first is loose pluralism which supports the use of a variety of research approaches but does not specify how or when to use positivism or interpretive. The second is

complementarism which advocates the use of different approaches based on different assumptions about the context of use. A complementarism approach employs a positivist approach in one situation and an interpretivist in another situation based on the research question and methods used. Lastly, Mingers supports a strong pluralism approach to mixed method where all research is seen as complex and multi-dimensional and would benefit from a range of methods.

Strong pluralism advocates for the use of different approaches for different activities. Mingers (2001: 245) posits that, "research is a process with different types of activities which will predominate at different times. Particular research methods are more useful for some functions than others, so a combination of approaches may be necessary to provide a more comprehensive research outcome." The advantages of multi-method research include the ability to gain a wider comprehension of the situation by approaching the situation from different perspectives, to validate findings by combining a variety of methods, and to stimulate innovation and creativity by introducing new ways of knowing.

The implementation of a multi-method research project is not without challenges, however. Mingers (2001) outlines three main challenges for the researcher when conducting a multi-method study. The first is philosophical in that the two approaches are so different ontologically and epistemologically that the researcher must select one approach. The assumption is that philosophically, positivism and interpretivism are polar opposites, representing competing "truths" about the world and cannot be reconciled. Mingers writes that recent research has found flaws in this assumption. Mingers and others support the philosophy that different approaches provide different perspectives into reality that is more complex than traditional theories can reflect (Mingers, 2001, Evered and Louis, 1981, Stone, 1990, Lee, 1991).

The second challenge is cultural in that the IS community has traditionally held that positivism in only valid scientific approach (Lee, 1991). The dominance of positivism is reflected in the criteria of IS journals, the focus of dissertation supervisors and the work of leading IS researchers (Mingers, 2001). Also, many researchers are not trained in multiple approaches and therefore work in the area that

they are most comfortable. In order to address this challenge, changes need to occur in academic curriculums, publication criteria, and researcher qualifications (Mingers, 2001).

The third challenge is psychological and the ability of a researcher to move from one approach to another. The migration between multiple approaches requires intentional consideration to each approaches characteristics, which will be discussed in more depth in the following paragraphs. In addition, researchers, like any individual, have preferred personality styles and comfort areas. The researcher must overcome research preferences and work in new areas which may require training and collaboration across disciplines (Mingers, 2001). Lastly, there exists a number of practical barriers to multi-method research. Researchers are continually under pressure to publish, especially young faculty seeking tenure and UK universities preparing for the Research Assessment Exercise (RAE). It is easier to publish in the traditionally accepted, positivist culture (Mingers, 2001).

Overall, these challenges are not insurmountable and are necessary to address the complex environment of IS research. In their seminal article, Evered and Louis (1981: 386) posited the need for multi-methods by writing, "greater epistemological appreciation seems to be an essential prerequisite to developing an appropriate inquiry approach whereby researchers would explicitly select a mode of inquiry to fit the nature of the problematic phenomenon under study, the state of knowledge, and their own skills, style and purpose."

In order to understand which approach to adopt in each situation, the researcher must understand the implications of each research perspective and act in ways that reflect that knowledge (Orlikowski and Baroudi, 1991, Lee, 1991). Evered and Louis provide a means of understanding the implications of the two research perspectives through the terms "inquiry from the outside", referring to the analytical/positivist approach and "inquiry from the inside", representing the interpretive approach to ways of knowing. (Evered and Louis, 1981). Inquiry from the inside should be used to explore a particular situation or organization in order to gain an understanding of that organization, similar to the interpretive approach. The resulting knowledge would be used in that context to better understand that

organizations needs. Inquiry from outside, similar to positivist research, is appropriate when testing a theory or looking to gain a universal truth. There is no right or wrong approach, the choice of approach should depend on the research question, the situation, and the researcher's expertise (Evered and Louis, 1981).

Stone (1990) adapted concepts from Evered and Louis (1981) to create a summary of analytical, or positivist, and interpretive modes of inquiry in relation to the research characteristics. Table 4.1 outlines the extremes of the approaches and assumptions associated with the analytical dimensions (Evered and Louis, 1981, Stone, 1990). The first assumption has to do with the researcher's role as an onlooker or inquirer from the outside versus as a participant in the organization or inquirer from the inside. The relationship of the researcher to the organization is assumed to range from the detached, neutral, unbiased observer who has no influence over the results of the study to the immersed, involved, active participant who becomes a part of the phenomena of the research. The researcher then validates the findings through measurement and logic versus subjective interpretation and experience.

Different assumptions also exist as to how research data is organized and classified. The positivist approach is to predefine or pre-organize the data which serves as justification for hypotheses and guides the data collection process. On the other hand, the interpretive study would not have predefined categories. Interpretive evaluations would begin with observations and categories would emerge as the data is reviewed and interpreted.

Another difference is the aim of the research. As outlined above, the aim of a positivist study is to generalize the results for universal applicability, whereas the interpretivist's goal is to understand a particular situation and how that understanding could be applied or relevant to other environments. It follows then, that the type of knowledge acquired also differs. The positivist generates universal or theoria knowledge, whereas the interpretive research would result in praxis knowledge, the knowledge of how to act in particular situations. Theoria knowledge attempts to be universally true and has the ability to predict and explain events. Praxis knowledge does not exist independent of understanding the subjective

environment within which it was received. Praxi knowledge provides detailed, relevant information for a particular context but is of questionable applicability to other settings, whereas theoria knowledge provides generalizable information that is of questionable value in understanding unique contexts and settings.

This leads to assumptions as to the nature and meaning of the research data. The positivist creates data that is free of setting and context and completely factual, whereas the interpretive information is contextually embedded in the complex environment from which it was gathered and cannot be separated. These assumptions, then, lead to the type of language used by the researcher when evaluating and presenting the findings. Positivists utilize quantitative language that is characterized by high precision and low variety. The qualitative language of the interpretivist focuses on the perspectives of the members of the organization with low precision and high variety. The term "variety" reflects the ability of the researcher to express the complex range of characteristics of the study that is available to the qualitative research. Precision, on the other hand, reflects the ability of positivists to provide exact measurements of the item being studied (Stone, 1990).

| **Characteristic** | **Analytical (Positivist)** | **Interpretive** |
|---|---|---|
| Researcher's Role | Onlooker | Participant |
| Researcher's Relationship to Setting | Detached, Neutral | Immersed, Involved |
| Validation Basis | Measurement and Logic | Experiential |
| Sources of Categories | Predefined | Emergent |
| Aim of Inquiry | Universality and generalizability | Situational relevance |
| Knowledge Acquired | Universal, Nomothetic: Theoria | Particular, Idiographic: Praxis |
| Nature and Meaning of Data | Factual, Context Free | Interpreted, Contextually Embedded |
| Evaluation Language | Quantitative (High precision, low variety) | Qualitative (Low precisions, high variety) |

Table 4.1: Characteristics of Analytical and Interpretive Evaluation (Stone, 1990, Evered and Louis, 1981)

To summarize, both approaches have something to offer a researcher and do not necessarily have to be mutually exclusive (Trauth and Jessup, 2000, Lee, 1991). As Evered and Louis (1981: 392) write, "One is methodologically precise, but often irrelevant to the reality of organizations; the other is crucially relevant but often too vague to be communicated to or believed by others." By understanding the implications of each approach, it is possible to deploy the approach most appropriate for the researcher, the research question, and the research method.

Lee (1991) outlines three levels of understanding when integrating positivist and interpretive approaches. The first is subjective understanding which defines an individual's everyday common sense and how they see themselves and the world around them. The second is interpretive understanding, which reflects the researcher's understanding and interpretation of the subjective understanding, developed through the use of qualitative research methods such as interviews and participant-observation. Lastly, positivist understanding reflects the rules of formal logic and consists of theoretical propositions. Lee goes on to posit that a researcher may use multi-methods when he (1991: 364) wrote, "the organizational researcher may, with justification and without contradiction, utilize a range of methods that are objective and subjective, nomothetic and idiographic, quantitative and qualitative, outsider and insider, and etic and emic."

This research will use a hybrid approach as appropriate for each research method. A positivist approach is valuable in trying to understand why people adopt and use a new technology. The ability to predict adoption and use would significantly improve the success of technology implementations. On the other hand, an interpretive approach would be valuable in understanding a particular environment and identifying interventions unique to that situation that would support that institutions technology implementation. Therefore, the adoption of a hybrid strategy as a research methodology will provide a more comprehensive understanding of an organization and its technology implementation.

This section defined the two extreme epistemological approaches to research and the need to look at both positivist and interpretive as valid approaches to IS research.

The section also described and justified the use of multi-methods to provide a comprehensive understanding of the organization and context being studied. The next section will discuss methodology, or the ways a researcher inquires into the world in order to create knowledge, and how the researcher goes about obtaining new knowledge (Punch, 1998).

### 4.2.3 Research Methods

There are three main outcomes for any research project: change, prediction, and understanding (Braa and Vidgen, 1999). The choice of research method is dependent on the desired outcome and can be loosely categorized as experiment, case study, and action research (Braa and Vidgen, 1999). Figure 4.1 outlines Braa and Vidgen's (1999) framework which defines common research methods and their desired outcomes.

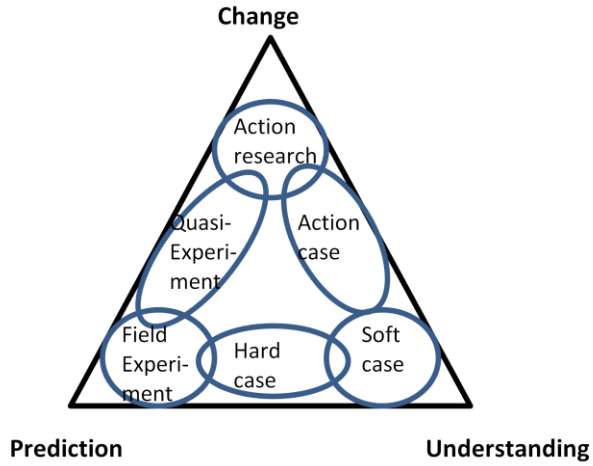


Figure 4.1: An IS Research Framework (Braa and Vidgen, 1999: 32)

The points of the triangle represent ideal outcomes for the research. Prediction is most closely associated with a positivist approach and understanding correlates with an interpretive approach, as defined in the previous section. Change is associated with an interventionary approach and is concerned with a problem and the desire to improve a situation (Braa and Vidgen, 1999).

The circles inside the triangle represent research methods. They are located within the triangle based on their desired outcomes (Braa and Vidgen, 1999). Table 4.2

outlines the research methods, their desired outcome and the epistemological approach to each.

| Research Method | Description | Outcome | Epistemology |
|---|---|---|---|
| Action Research | A cyclical process of action, evaluation and reflection, and intervention. Action research's main objective is to better understand an organization in order to change it for the better. | Change | Interpretive |
| Action Case | A hybrid of action research and soft case study. | Change and Understanding | Interpretive |
| Soft case | A case that does not meet all of the requirements of a hard case study. It is used to gain an understanding of an organization that can be used beyond the particular case | Understanding | Interpretive |
| Hard Case | An empirical investigation into a real-life organization to answer a 'how' or 'why' question. | Prediction and Understanding | Positivist |
| Field Experiment | An extension of a laboratory experiment brought into an organization utilizing quantifiable analysis. | Prediction | Positivist |
| Quasi-Experiment | A field experiment that does not meet the criteria of a control group, randomization, and experimental control which eliminates unnecessary variables. | Prediction and Change | Positivist |

Table 4.2: Research Methods and Outcomes (Braa and Vidgen, 1999)

The outcomes and methods are simplified for the purpose of discussion. In reality, a research project may need to incorporate a variety of methods and outcomes to satisfy the research questions. Braa and Vidgen (1999) provide a framework for discussion and understanding of the association of methods with outcomes. This framework also provides for the possibility of hybrid methods by combining the needs of change, prediction and understanding into methods such as hard case, quasi-experiment and action case.

Following Mingers (2001: 256-257), research methods should be based on the research context and when "designing methodology for any research study, consideration should be given to the different dimensions of a real situation, material, social and personal; to the tasks involved in the different stages of a research study; and to the research context (including the capabilities and characteristics) of the researcher(s). This should lead, if possible and appropriate, to the construction of a multimethod, multiparadigm research design."

This section briefly outlined a number of research methods, their desired outcomes and their associated epistemologies. Again, this section justifies the appropriateness of a hybrid approach to research methods as best fits the situation. The next section will outline the specific research design of this study.

## 4.3 Research Strategy

The research strategy consists of mixed or hybrid methods based on the desired outcome of each aspect of this research. This section outlines the research questions and the strategy associated with each. As described in Chapter three and outlined in Figure 4.2, the conceptual framework of this research posits the use of social network analysis to measure social capital in order to strengthen the social influence construct of the UTAUT model and to inform membership in a CoP whose role would be to support a technology implementation. As illustrated in Figure 4.2, the research strategy is divided into two distinct areas. The next two sections outline the propositions for each area and the research method used.

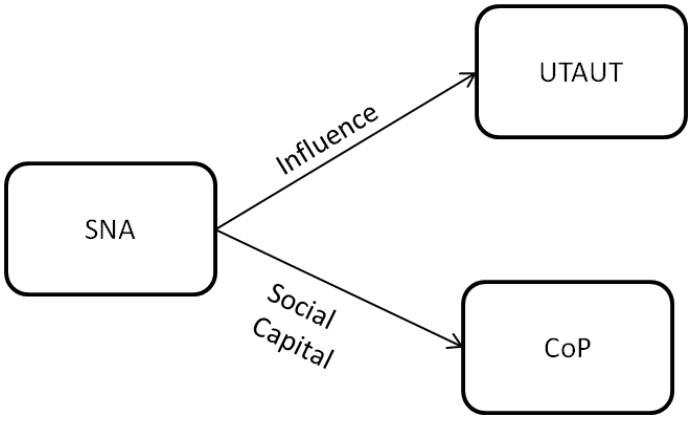


Figure 4.2: Conceptual Framework

### 4.3.1 Proposition 1: Social Capital to Predict Technology Acceptance

The technology acceptance aspect of the research follows a quantitative, non-experimental strategy from a positivist perspective (Punch, 1998). This epistemology is used for this aspect of the research because the goal is to build on the research of Venkatesh et al. (2003) in an effort to universally predict an individual's intention to use a new technology. The UTAUT model contains predetermined relationships that are constructed to predict behavioral intention to use a new technology which, theoretically, measures adoption. This type of research, with universal applicability and predetermined relationships, naturally falls into the positivist ways of knowing.

As outlined in Chapter three, the UTAUT model is comprised of four main determinates and four moderators that predict behavioral intention to use a new technology and ultimately, actual use of that technology (Figure 4.3).

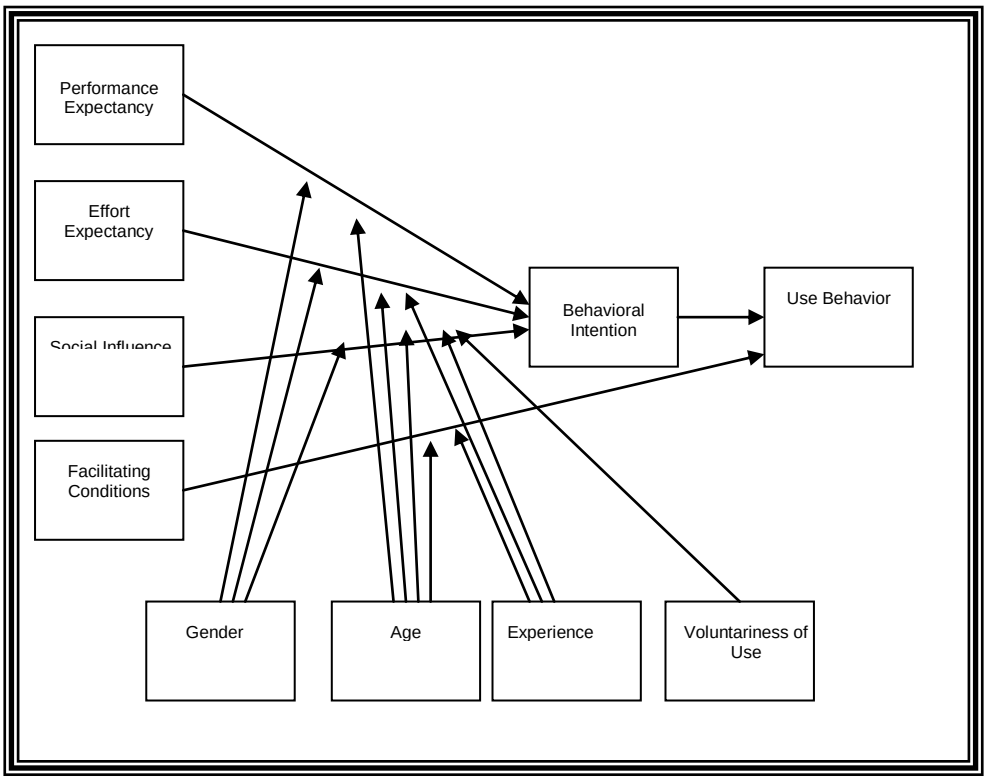


Figure 4.3: Original UTAUT Model (Venkatesh et al., 2003: 447)

This research posits that social capital replaces the social influence construct in the UTUAT model utilizing centrality measures as identified through social network analysis: degree, closeness and betweenness. These measures have not been used in previous Information Systems research to predict behavioral intention to use a new technology.

The original UTAUT model measures social influence through the use of four questions:

1. People who are important to me think I should use the new technology?
2. People who influence my behavior think that I should use the new technology?
3. The senior management of my College has been helpful in the use of the new technology?
4. In general, my College has supported the use of the new technology?

Social capital, as identified through centrality measures, on the other hand, looks at the organization's informal network and the relationships between members of the group as related by participants in the network. Social network analysis contains centrality measures that quantify, using graph theory, the importance or prominence of an individual in an organization's informal network (Wasserman and Faust, 1995). These individual centrality measures will be looked at as stand-alone measures, as well as collectively, to better understand their correlation to an individual's behavioral intention to use a new technology.

Burkhardt and Brass (1990) found that power and centrality did not predict early adoption of a new technology. However, Burkhardt and Brass (1990) went on to posit that central figures were the first of the later adopters, learning from the early adopters. These central figures understood their network and used it to their advantage to adapt to change. Ibarra (1993) found that centrality and power were significant predictors of administrative innovation roles, but not as much on technical innovation. Informal network centrality was a strong determinant of involvement in innovation efforts on the administrative side, but not as strong on the technical side. Ibarra (1993) reflected that this finding could have been caused by

the composition of the sample in that technical innovations were restricted to fewer members of the network than administrative innovation.

Both of these research projects were conducted over fourteen years ago, when technology implementations involved the central information systems office and a few key staff members. An enterprise-wide technology implementation today, could be considered analogous to an administrative innovation of the 1990's, in that it touches almost all professionals in the organization. Therefore, this model will posit that centrality is a significant predictor of adoption of a new technology.

This model will adopt the same moderators as the original UTAUT model. Venkatesh et al. (2003) referenced theories that suggest women tend to be more sensitive to other's opinion and therefore would be more inclined to be influenced by important others. Theory also suggests that as people get older, they are more likely to be influenced by others. Thirdly, social influence seemed to be mediated by experience. Individuals, during the early use of a new technology, seem to be more strongly influenced by social factors than later on during sustained usage (Venkatesh et al., 2003). The same criteria exist within the revised social capital construct as they do with the social influence construct. Centrality has been found to be a strong predictor of performance (Ahuja et al., 2003). Therefore, the voluntariness of use moderator will hold true. If individuals perceive the new technology to be mandatory, central individuals will adopt the technology in order to meet or exceed performance expectations.

This research, then, looks at the following proposition and hypothesis:

> Proposition 1: Is social capital, as identified through SNA, a stronger predictor of Behavioral Intention than the Social Influence construct of the UTAUT model?
>
> > H1: Social capital, as measured by SNA, will correlate with Behavioral Intention (BI/UTAUT). The higher an individual's social capital in an organization, the greater their intent to use the new technology (Figure 4.4).

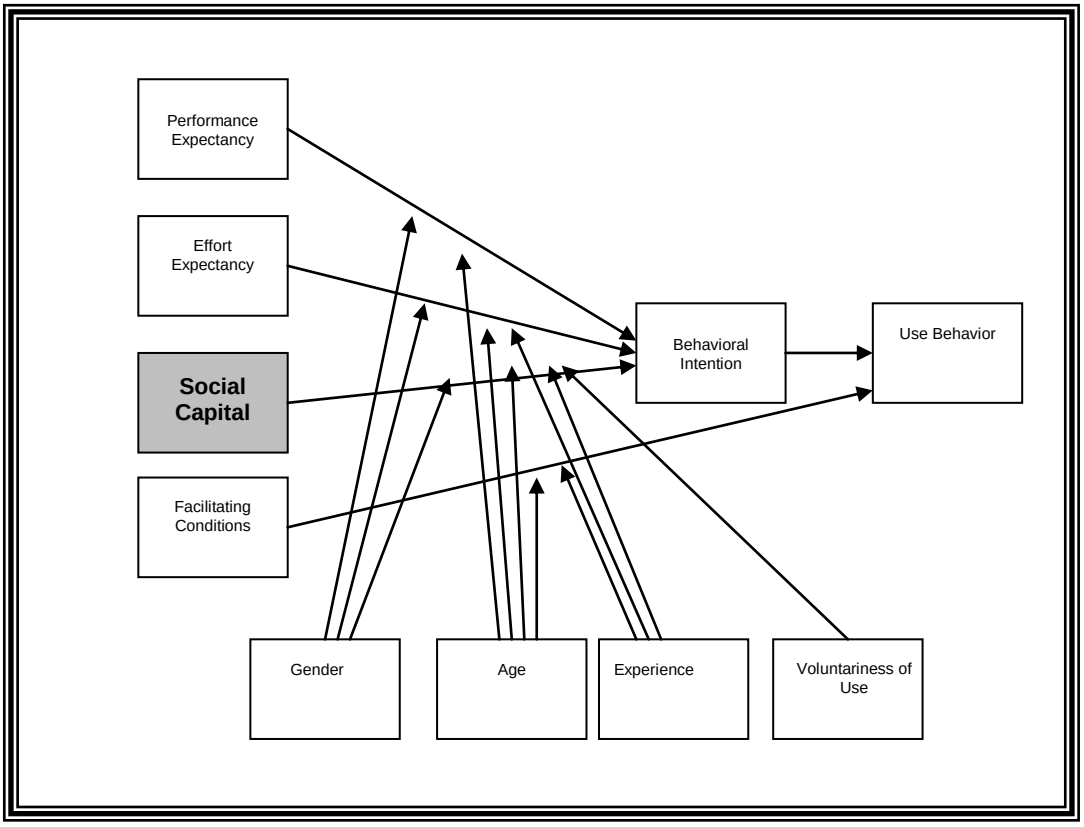


Figure 4.4: H1: Social Capital UTAUT

Another way to look at social capital is in the influence those with social capital have over others. People value the attitudes and opinions of those close to them in their informal social network. Decision patterns and by extension, decisions to adopt a new technology tend to follow network structures. The Social Influence construct of the UTAUT model and the concept of influence in social network analysis is similar in that each measures the influence of important others on an individual's attitudes, opinions, and actions. Replacing the Social Influence determinant with a SNA influence measure in the UTAUT model may be another way to better predict an individual's behavioral intention to adopt a new technology.

This SNA influence will look at proximity of other actors to an individual and weight the other actors' BI based on closeness or influence to the individual. These SNA influence measures quantify the prestige of others based on proximity in the informal network (Wasserman and Faust, 1995). Others are judged to be more prestigious, the closer they are to the individual and therefore have more influence over their opinions and actions.

Therefore, this research looks at the following hypothesis in relationship to proposition 1:

> Proposition 1: Is social capital, as identified through SNA, a stronger predictor of Behavioral Intention than the Social Influence construct of the UTAUT model?

> > H2: The Behavioral Intention (BI/UTAUT) of important others, others who are close to an individual in his social network, will influence his Behavioral Intention to use a new technology. The higher the BI scores of those close to an individual, the higher that individual's BI (Figure 4.5).

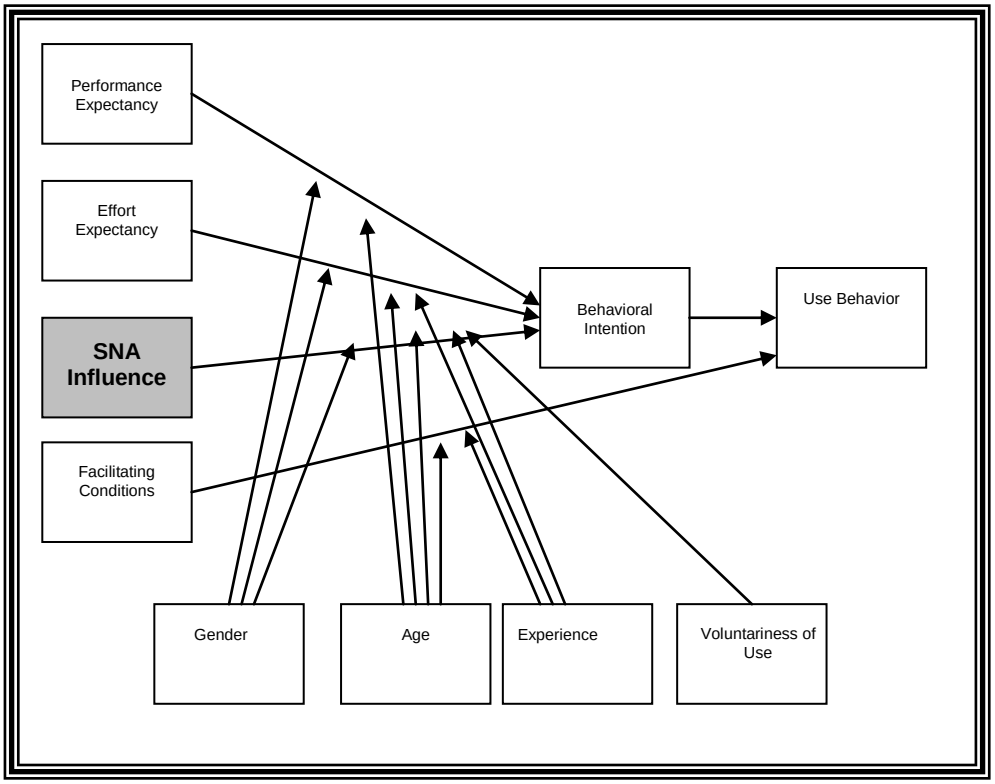


Figure 4.5: H2: SNA Influence UTAUT

The research method used for proposition 1 is field experiment. This method is appropriate because the UTUAT model is an established way to understand technology acceptance universally and is similar to a laboratory experiment in that

the researcher uses an established survey tool to gather data from some sort of population and performs established statistical analysis on that data.

Figure 4.6, illustrates the use of field experiment with the outcome of predicting an individual's intent to use a new technology. The formal definition of a field experiment is that it is an extension of a laboratory experiment utilizing a control group and a treatment group to precisely measure relationships between variables (Punch, 1998, Braa and Vidgen, 1999). The goal of a field experiment is to make a generalizable statement which can be applied to real-life organizations. The two groups are alike in all aspects except they are treated differently. The control group most likely has nothing done to it, whereas the treatment group receives some type of manipulation to one of the variables (Punch, 1998). The difference between the two groups is then quantifiably measured.

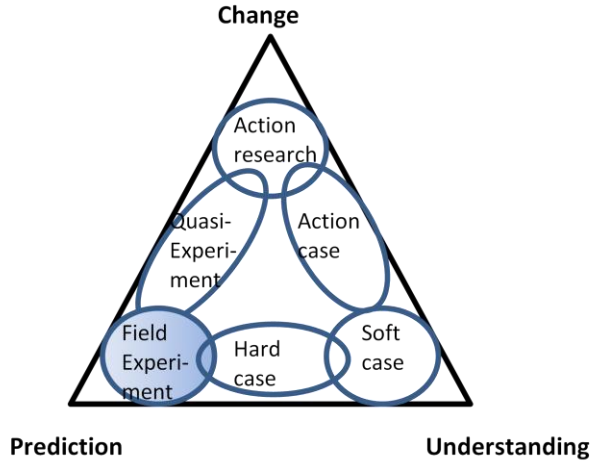


Figure 4.6: Field Experiment Method (Braa and Vidgen, 1999: 32)

It is virtually impossible, however, to create two identical groups of human beings with exactly the same variables. Researchers have determined that the best way to address this issue is the random assignment of individuals to comparison groups (Punch, 1998). Random assignment to groups does not guarantee equality, but it does maximize the potential that comparison groups will not differ in a systematic way (Punch, 1998). There are two types of field experiments. The first is a 'true' experiment that meets the criteria of randomization and experimental control and the

second is ‘quasi’ experimental design which attempts to function as close to the ideal as possible in that research setting (Braa and Vidgen, 1999).

This research is most closely associated with a field experiment. There was not access to clear-cut comparison groups, therefore, statistical analysis was used, as described later in this paper, to measure a number of variables obtained from survey questionnaires from three samples of higher education professionals. Prospective description research was used to collect specific data for the purpose of predicting technology acceptance in an organization based on existing perceptions and behavioral intentions (Domholdt, 2005). Prospective description research allows the researcher to control the data collected for the purpose of measuring specific relationships (Domholdt, 2005). In this case, the data was collected through an established survey and used to test the UTAUT model and its underlying theories (Punch, 1998).

### 4.3.2 Proposition 2: Social Capital to Inform Communities of Practice

The Community of Practice aspect of this research is approached from an interpretive epistemology utilizing an action case with the goal of improving the acceptance of a new technology in a higher education organization. The interpretive approach was appropriate because the outcome of this aspect of the research was to better understand a particular organization’s technology implementation process from an internal perspective in order to gain knowledge and make interventions to improve that organization’s technology implementation. The ultimate goal was to gain knowledge of one organization with the aim of applying similar methods to other organizations.

In addition to the use of a technology acceptance model, as described in the previous section, this research looks at another way an organization could leverage the social capital existing in their organization’s social network. This research posits that an organization could support a technology implementation through the creation and nurturing of a Community of Practice (CoP) to diffuse the new innovation into the organization.

As defined in Chapter two, a CoP is a "group of people who share a concern or a passion for something they do and learn how to do it better as they interact regularly" (Wenger, 2007b: 1). IT vendors and consultants have utilized CoP for promoting the use of IT for organizational knowledge management (Davidson and Heslinga, 2007). Knowledge is created through practice and participation in process with community (Brown and Duguid, 1991). A higher education organization is like a community with faculty, staff, and administrators working together in their mission to teach students. A technology implementation within a community requires learning and sharing of new knowledge. Therefore, this research posits that the local knowledge necessary to implement an enterprise-wide technology requires practical experience and community participation (Davidson and Heslinga, 2007).

Research has also found that when a technology is being implemented, early users should be people who are positive about that new technology and important, informal leaders in their work groups or the organization as a whole (Fulk, 1993). By identifying people with social capital and an intent to use the new technology, project leaders could form a CoP, comprised of these important, informal leaders, whose role it is to support the technology implementation. In addition, it has been found that individuals with social capital play an important role as change agents and in the sharing of knowledge (Frank et al., 2004, Wasko and Faraj, 2005). Those who are central in the organization have access to resources, established communication patterns, and collaboration networks. They have strong reputations and powerful relationships. Their opinions and attitudes could be used to influence and motivate others to adopt the new technology (Hatzakis et al., 2005). This CoP can leverage its combined social capital to gain access to resources, communicate and collaborate more effectively, and influence others to adopt the new technology.

Therefore, this research, in proposition 2, looks at a way to better understand the relationship between an organization's social network of relationships and a CoP, whose role would be to form a community to support a technology implementation and successfully manage the associated information sharing, problem solving, and innovation (Cox, 2005, Wenger et al., 2002).

Proposition 2: How can a Community of Practice comprised of individuals with high social capital be enrolled to support a technology implementation?

The research method used for proposition 2 is action case. This method is appropriate because proposition 2 seeks to both gain an understanding of a particular organization in a specific situation as well as make interventions with the goal of creating change that improves the technology implementation (Braa and Vidgen, 1999). Figure 4.7, illustrates the use of action case with the outcome of both understanding and change.

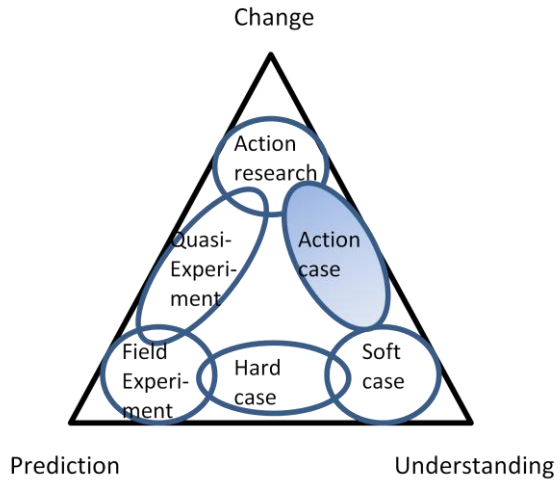


Figure 4.7: Action Case Method (Braa and Vidgen, 1999: 32)

The soft case aspect of this action case was the desire of the researcher to better understand the implications of the use of individuals with high social capital as members of a CoP in a higher education organization's technology implementation. The findings would then be qualitatively reflected upon to determine if there was applicability in other organizations who were also implementing an enterprise-wide technology (Braa and Vidgen, 1999).

The action research aspect of this action case has to do with the fact that this research follows a single iteration of an action research cycle as defined by Susman and Evered (1978) and illustrated in Figure 4.8. Action research is appropriate in order to study social and organizational processes involved in the adoption and acceptance of a new technology implementation (Davidson and Heslinga, 2007).

Davidson and Heslinga (2007: 20) found action research to be important "for information systems researchers in health care to demonstrate the value of organizational and information systems theories for addressing Health Information Technology problems and to establish collaborative relationships across disciplines." By extension, this research is an appropriate approach to better understand IS implementation issues and collaborative relationships across disciplines in higher education organizations.

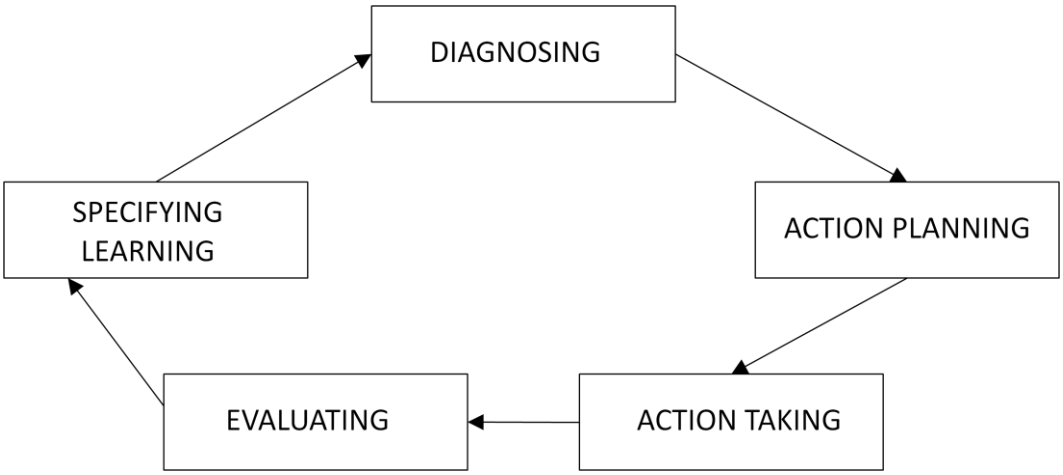


Figure 4.8: Action Research Cycle (Susman and Evered, 1978: 588)

Action research is defined as participative, concurrent with the action, a sequence of events, and an approach to problem solving (Coghlan, 2004). The five phases of the cycle are important in understanding action research. The first phase, diagnosing, allows the researcher and the organization to assess the current situation and determine how to approach it. The second phase, action planning, involves the identification of actions based on theoretical frameworks (Braa and Vidgen, 1999). This review of alternative possibilities informs phase three, action taking, which consists of carrying out interventions (Davidson and Heslinga, 2007). The fourth phase of action research is evaluating. This important step involves evaluating the outcomes of the intervention and reflecting on the consequences of the prior actions. The last phase, specifying learning, indentifies which outcomes were met, which were not met, and what additional interventions could be implemented to achieve the desired outcome (Davidson and Heslinga, 2007).

In this research, the case is bounded by key staff involved in the technology implementation (Punch, 1998, Domholdt, 2005). The purpose or focus of this action case was to gain a better understanding as to how individuals with social capital, who are central in an organization's social network, support an IS implementation. Multiple sources of data, which is characteristic of qualitative research, were used including multiple social network analysis measures and interviews (Punch, 1998). Individual semi-structured interviews were conducted in order to better understand an individual's perceptions and attitudes as to the how the Community of Practice supported the technology implementation (Punch, 1998, Domholdt, 2005).

### 4.3.3 Hybrid Approach

This section defines the hybrid approach of this research study. The complex nature of studying technology implementations within organizations, and specifically, the use of social capital to support technology acceptance, requires the use of multiple research methods. Table 4.3 summarizes the propositions of this research, the research method, the desired outcome and associated epistemology.

| Proposition | Research Method | Outcome | Epistemology |
|---|---|---|---|
| Proposition 1: Is social capital, as identified through SNA, a stronger predictor of Behavioral Intention than the Social Influence construct of the UTAUT model? | Field experiment | Prediction | Positivist |
| Proposition 2: How can a Community of Practice comprised of individuals with high social capital be enrolled to support a technology implementation? | Action Case | Change and Understanding | Interpretive |

Table 4.3: Research Strategy Summary

The next sections provide in-depth descriptions of the cases used in this research followed by the data collection and analysis methods for each aspect of the conceptual framework: social networks, technology acceptance, and Community of Practice.

## 4.4 Research Design

This section defines the cases used in this research. From a social network perspective, this research seeks to gain an understanding of how social capital can be utilized in a higher education context to support a technology implementation through the use of field experiment and action case methods. The unit of analysis is three higher education organizations. The cases were selected based on the fact that each organization was in the early-stages of implementing a new technology that was strategic in nature and required employees to change their work processes. The project leadership in each case organization were also willing to provide access to the researcher. Pseudonyms are used for confidentiality reasons. The findings are combined but not the data or the methods (Punch, 1998).

This research was conducted on professional staff in three higher education organizations. The selection of the sample, or group, to be studied, is an important part of a research project. For social network analysis, the case organization must have a clear set of boundaries with a theoretical, empirical or conceptual reason to belong together (Hanneman and Riddle, 2005, Wasserman and Faust, 1995). When looking at an impact to an organization, the selected sample should also be of interest or strategic importance (Cross and Parker, 2004). It does not necessarily need to follow the formal organizational chart. In fact, greater benefits are often achieved if the sample is not part of the formal hierarchy. Therefore, it is acceptable to select a sample that crosses functions, hierarchies and physical boundaries depending on the goal of the research project.

Two ways to analyze a population in SNA research are sampling an entire organization (full-network) or a subset of the organization (snowball method) (Hanneman and Riddle, 2005). In the full-network method, the researcher collects data on each node in the sample or organization. This results in a complete census of ties or relationships within a population of actors. The snowball method starts with a set of actors and then adds actors named but not in the original set to the sample. Data collected using the snowball method cannot directly inform the

researcher about the overall embeddedness of the networks in a population, but can provide information on the prevalence of various kinds of ego networks.

This research used the full-network method in three purposive samples, selected groups of participants from each university that met the sample criteria outlined above and were involved in that university's technology implementation (Domholdt, 2005). Each sample consisted of a group of individuals who had recently received training on the new technology. Table 4.4 outlines each case and the research methods and data collection methods used in this research.

| | **Research Method** | **Data Collection Method** |
|---|---|---|
| Alpha University | Field Experiment<br><br>Action Case | Social Network Analysis<br>UTAUT surveys<br><br>CoP interviews |
| Saints College | Field Experiment | Social Network Analysis<br>UTAUT surveys |
| Midwest University | Field Experiment | Social Network Analysis<br>UTAUT surveys |

Table 4.4: Summary of Case Organizations and Research Methods Used

### 4.4.1 Alpha University

The first sample will be called Alpha University. It is a top-ranked research university of almost 12,000 students located in the United Kingdom 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 156 staff and 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. These individuals crossed physical, departmental, and hierarchical boundaries providing a good sample as defined by Cross and Parker (2004).

### 4.4.2 Saints College

The second university will be called Saints College and is a private, liberal arts college of about 3,000 students located in the upper Midwest, United States. In Spring 2007, Saints College began a college-wide implementation of a document imaging system. The goal of document imaging projects are to improve productivity by streamlining processes and, in addition, helping the environment by reducing paper consumption. One of the first groups to be trained on the new system was the fundraising department. Sixteen members of the fundraising department were trained on the document imaging system the week of May 7, 2007. This sample included members of the same formal organizational department with different job descriptions. The sample included only members of the fundraising department that attended the training.

### 4.4.3 Midwest University

The third university will be called Midwest University and is a private, comprehensive university of about 4,300 students located in the Midwest, United States. The University recently completed an implementation of an institution-wide administrative system and was planning on starting a business intelligence project. In May 2007, a group of staff attended an orientation on a business intelligence reporting tool. These tools are designed to provide a university with a comprehensive, state-of-the art, robust business intelligence solution for reporting and strategic planning. The sample of forty-four individuals included a cross section of staff members from across the university to include managers in functional departments as well as information technology staff. The sample consisted of the staff who would be involved in using data from the administrative system, all of whom attended the training held the week of May 29, 2007.

The analysis of these three samples will add to Venkatesh et al.'s (2003) research in two ways. First, this research adds to existing technology acceptance research and

provides additional insight into the UTAUT model. Second, the sample consists of professional employees instead of students. Much of past research, due to convenience, has been with students. These studies utilizing professional staff will add credibility and depth to technology acceptance research.

The next sections outline the data collection and analysis methods for each aspect of the conceptual framework: social networks, technology acceptance, and Community of Practice.

## 4.5 Social Network Analysis to Measure Social Capital

The first aspect of the conceptual framework, which informs both technology acceptance and CoP, is social capital (Figure 4.9). This section will define the data collection and analysis methods used in this research.

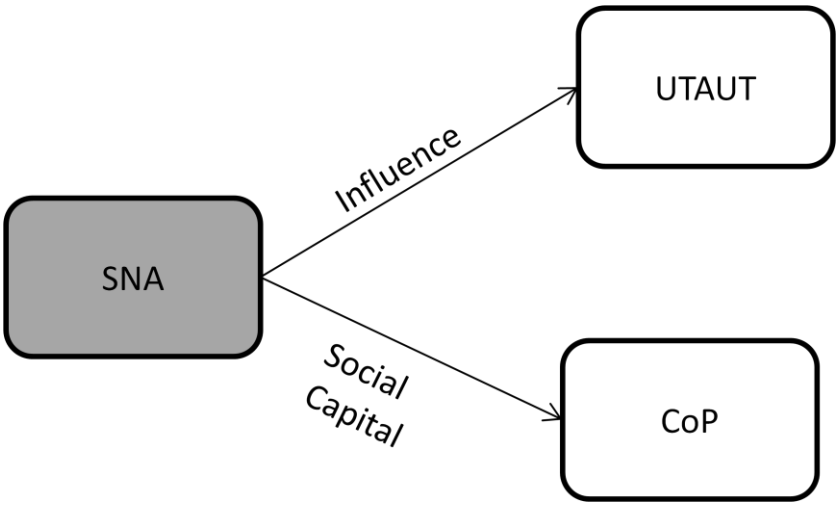


Figure 4.9: Social Networks Inform UTAUT and CoP

### 4.5.1 Data Collection Method: Survey

The data collection method used for social network analysis is a survey. A questionnaire is the most commonly used method for collecting social network data (Wasserman and Faust, 1995). The questionnaire usually contains questions about an individual's relationships to other actors. An extensive literature review was performed in an attempt to determine the questions to be included on the survey.

Martin van der Gaag's resource generator was reviewed (Gaag and Snijders, 2005, Gaag, 2005). The resource generator is a survey instrument for the measurement of individual social capital. It generates a list of resources an individual has access to. The list does not ask for names, but measures tie strength by the type of access (family member, friend, acquaintance). Van der Gaag uses item response theory to analyze the data. He asserts that it is quicker and easier than a name generator with more possibilities for use in goal specific research. He also asserts that it is more of a challenge to construct the questionnaire as each researcher must develop the appropriate questions for their particular study and its measures have limited use. These generators do not map ego-centered networks like a name generator/interpreter and would not facilitate the type of social network analysis intended in this research.

Ken Franks has also done research on social capital and the Diffusion of Innovations within organizations (Frank et al., 2004). He used a survey instrument that asked the same types of questions as the UTAUT instrument. His social capital questions were:

- Who are your closest colleagues in your school?
- With whom do you talk about new uses for computers in your teaching?
- With whom do you talk about new ideas for the curriculum?

Two research projects that used Krackhardt (1990) as the source for their surveys were consulted. The first, Tenkasi and Chesmore looked at Krackhardt's 'philos' and used the following questions to measure strong ties of interaction, sharing, trust, and time (Tenkasi and Chesmore, 2003):

- How often do you go to each of the following teams/members for advice/information?
- How often have you worked with members of each of these teams to solve an issue/problem?
- How often have you shared time, resources, space with each of these teams/members?
- How often do you provide advice/information to the following teams/members?

Second, Ibarra and Andrews asked these two questions to measure centrality and proximity indicators (Ibarra and Andrews, 1993):

- Who are important sources of professional advice, who you approach if you have a work-related problem or when you want advice on a decision you have to make?
- Who are very good friends of yours, people who you see socially outside of work?

Ronald Rice, in his research on social capital, referenced Scott, Rogers and Friedkin for these survey questions (Rice, 1994):

- Work network: How frequently do you communicate with this person about work projects?
- Familiarity network: To what extent are you familiar with the details of what the following people are working on?

Lastly, Burt's article, "The Network Structure of Social Capital", suggested that people with few peers and high task uncertainty make better samples to study social capital (Burt, 2000). He goes on to say that people using less familiar technologies, on less clearly-defined problems are also good.

Burt summarized name generators/name interpreters as follows.

Name generators:

- Who you spend time with
- Sources of success in job
- Difficult people
- Important for achievements
- Discuss and evaluate job options

Name interpreters:

- Strength of relationships
- Length of time known the contact
- Ties between contacts
- Type of relationship (colleague, friend, spouse, kin, etc)

Burt's sample questionnaire was very lengthy and not applicable to the scope of this research.

Cross and Parker's (2004) questions are very similar to Tenkasi and Chesmore and Ibarra and Andrews. Cross and Parker have used their questions extensively in the research of over sixty organizations. They outlined a number of questions that are designed to measure network relationships such as centrality and brokerage. These questions are broken into groups that reveal collaboration in a network, information sharing potential of a network, rigidity in a network, well-being and supportiveness in a network (Cross and Parker, 2004). These types of questions fit very nicely into a survey on technology acceptance and how an organization can predict or improve acceptance.

Based on this overview of literature, seven questions from Cross and Parker (2004) were selected that also incorporate Tenkasi and Chesmore and Ibarra and Andrews questions as the SNA section of the questionnaire. The questions would be answered for each member included in the sample representing the informal social network of that particular aspect of the technology implementation. For instance, Alpha University would answer each question for each of the staff member across the university who would receive training on the FMS and Saints College would answer each question for only the members of the fundraising department who received training on the document imaging software. A roster of the 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).

Seven-point scales were used for each question with different scales based on the question. The original questions were as follows. The bold headers indicate what each question was designed to measure.

**Q1: Collaboration/Communication** - How often do you talk with the following people regarding work and what is going on in the organization?

0= I do not know this person
1 = Daily
2 = Weekly
3 = Bi-weekly
4 = Quarterly
5 = Bi-yearly
6 = Yearly
7 = Never

**Q2: Collaboration/Problem Solving:** Who are important sources of professional advice, whom you approach if you have a work-related problem or when you want advice on a decision you have to make?

0= I do not know this person
1 = Extremely important
2 = Important
3 = Somewhat Important
4 = Neither important nor not important
5 = Somewhat not important
6 = Not important
7 = Not important at all

**Q3: Collaboration/Problem Solving:** To whom do you serve as an important source of professional advice, who approaches you when they have a work-related problem or need advice on a decision they have to make?

0= I do not know this person
1 = Extremely important
2 = Important
3 = Somewhat Important
4 = Neither important nor not important
5 = Somewhat not important
6 = Not important
7 = Not important at all

**Q4: Collaboration/Innovation:** How often are you likely to turn to this person in order to discuss a new or innovative idea or business process?

0= I do not know this person
1 = Daily
2 = Weekly
3 = Bi-weekly
4 = Quarterly
5 = Bi-yearly
6 = Yearly
7 = Never

**Q5: Well Being/Friendship:** Please indicate the people you consider to be personal friends, that is, those people you see most frequently for informal activities such as going out to lunch, dinner, drinks, visiting one another's homes, and so on.

0= I do not know this person
1 = Extremely close friend
2 = A close friend
3 = Somewhat close friend
4 = Neither close or not close
5 = Somewhat not close friend
6 = Not a close friend
7 = Not friendly

**Q6: Information Sharing/Access:** When I need information or advice on work-related issues, this person is generally accessible to me within a sufficient amount of time to help me solve my problem?

0= I do not know this person
1 = Extremely accessible
2 = Accessible
3 = Somewhat accessible
4 = Neither accessible nor not accessible
5 = Somewhat not accessible
6 = Not accessible
7 = Not accessible at all

**Q7: Information Sharing/Engagement**: If I ask this person for help with work related issues, I feel confident that he or she will actively engage in problem solving with me.

0= I do not know this person
1 = Extremely confident
2 = Confident
3 = Somewhat confident
4 = Neither confident or not confident
5 = Somewhat not confident
6 = Not confident
7 = Not confident at all

Confidentiality was an ethical issue involved in this research. An important aspect of SNA research is to understand where an individual appears on a social network

diagram. This allows managers and leaders to strategize on how to improve communication flow, innovation, and productivity (Cross and Parker, 2004). It was important to keep the research confidential and ensure the respondents understand that the information will in no way be used against them. The dissertation supervisor and the researcher were the only two individuals who had access the names of the respondents. Project leads at each university received results of the research that included names of participants. Each sample population were aware of the names of the individuals who would have access to confidential information prior to completing the survey.

All publications and data shared with the institutions or the public contained aggregate data or labels instead of names. A social network diagram without names is also a useful tool for discussion with all members of the population. These diagrams provide the participating institutions the opportunity to discuss ways to improve connectivity and collaboration as well as get to know each other and the organization (Cross and Parker, 2004).

### 4.5.2 Data Analysis: Social Network Analysis

The social network data was analyzed using a network analysis software package. A number of network software tools are available, including UCINET, NetDraw, Pajek, and Inflow (Cross and Parker, 2004). This research used a combination of UCINET and NetDraw due to the availability of documentation and access to expertise and assistance, if needed. Network software such as UCINET uses mathematical algorithms to represent and draw social networks. The resulting diagrams usually put people in the center who have the most ties and put people with the fewest ties near the outside.

This research identified central individuals in the network using three centrality measures: in-degree, betweenness, and closeness. The three measures are commonly identified as the standard measures of centrality following Freeman's (1979) seminal work (Brass and Burkhardt, 1992). These centrality measures were selected to analyze the social network data in this research in order to provide an

overall perspective of each case organization's informal social network (Freeman, 1978):

- In-degree for communication activity and prestige
- Betweenness for control of communication and leadership (Freeman et al., 1979)
- Closeness for an individual's independence and efficiency

This research relies on over 25 years of the use of these measures when looking at centrality (Freeman et al., 1979, Scott, 2000). These measures provide a reliable and quantifiable means to identify individuals who possess social capital in an information social network (Wasserman and Faust, 1995).

In addition to centrality measures, power and influence over others was explored through the use of closeness measures (Hanneman and Riddle, 2005). These measures look at the connections or relationships between an individual and others in the social network. The Hubbell and Katz measures, for example, count the connections between actors, weighting them according to length with the assumption that the greater the length, the weaker the relationship (Hanneman and Riddle, 2005). The Taylor influence measure looks at both an individual's outgoing and incoming connections, applies an attenuation factor resulting in a normed matrix (Hanneman and Riddle, 2005).

Another way to look at the influence of others in a social network is line or edge betweenness. Line betweenness measures which relations are most central rather than which individuals (Hanneman and Riddle, 2005). Interactions between individuals may depend on other actors and therefore control an individual's relationships (Wasserman and Faust, 1995). Line betweenness provides a way to quantifiably measure influential relationships. The result is a matrix illustrating the extent to which each relationship is between other relationships.

Friedkin (1998: 3) posits another theoretical way of looking at influence. His theory focuses on the "consequences of social structure for patterns of interpersonal influence and agreement among actors in different social positions." Friedkin's

research is based on theories where individuals form opinions through a network of interpersonal influences. The opinion forming process results in either disagreement or group consensus (Friedkin, 1997). The influences come from a balance inside the individual's environment and outside which Friedkin labels as endogenous and exogenous influences (Friedkin, 1997). Friedkin's theory goes on to posit that when individuals hold similar positions in a network, that is they possess similar demographic attributes and are structurally equivalent, their initial agreements will be maintained and disagreements will be reduced (Friedkin, 1997, Friedkin, 1998).

The use of influence measures is a new approach to understanding social influence in relation to an individual's behavioural intention to use a new technology. These measures are relevant in that they focus on influential relationships and their effect on opinions and behaviour which can be correlated to intention to adopt as well as use of new technology.

This section described the methods used in this research to collect and analyze social network data in order to measure social capital. The next section will focus on how this research collects and analyzes the data designed to measure an individual's intent to use a new technology.

## 4.6 Technology Acceptance

This section focuses on the data collection and analysis methods used in the technology acceptance aspect of this research in order to utilize the UTAUT model in predicting behavioral intention of individuals to use a new technology (Figure 4.10).

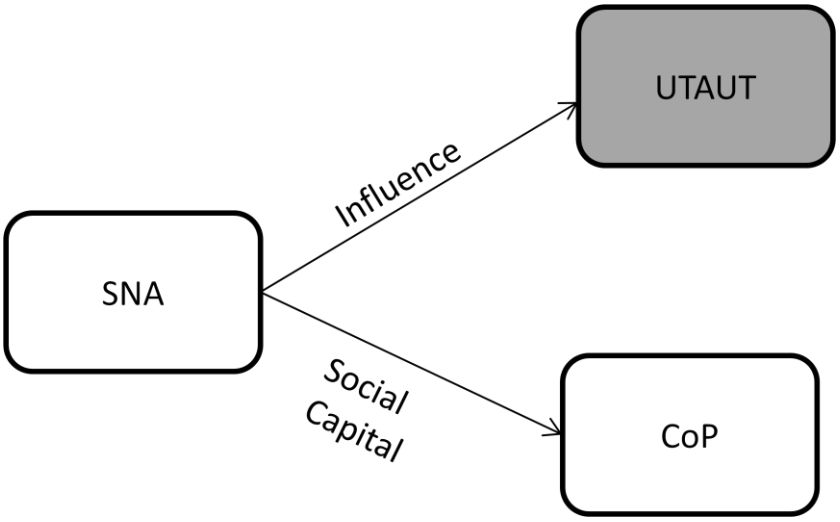


Figure 4.10: Technology Acceptance

### 4.6.1 Data Collection Method: Survey

The data collection method for technology acceptance is also the use of a survey because it facilitates the collection of non-experimental, self-reported information. The questionnaire also fits the time and resource constraints available for this research. The use of existing instruments not only saves time but also helps ensure reliability and validity of the research (Punch, 1998). An existing instrument provides a foundation upon which to justify and analyze the results of this research.

The standard limitation of surveys were taken into account in both the administration and analysis of the data. Limitations of questionnaires include (Domholdt, 2005, Punch, 1998):

- It is difficult to gather in-depth responses.
- The researcher cannot clarify questions, so there is a possibility of misunderstandings.
- The researcher does not have a "captive" audience making it difficult to ensure a high response rate.

The UTAUT questionnaire was selected for the technology acceptance aspect of the research because it has proven to be more reliable than other models (Venkatesh et al., 2003). The questionnaire consisted of the thirty-five questions designed to measure technology acceptance. Thirty-one questions were based on Venkatesh et

al.'s (2003) original instrument with the wording changed to reflect each sample's technology implementation. Four questions on voluntariness were included based on the focus of this research being social influence and Venkatesh et al.'s findings that technology acceptance is influenced socially, in mandatory settings, especially early in the implementation (Venkatesh et al., 2003). The four "voluntariness" questions were taken from Anderson and Schwager's research design and modified to fit the samples (Anderson and Schwager, 2004).

The UTAUT model is comprised of seven constructs that Venkatesh et al.'s (2003) research found to be significant factors in determining behavioral intent or use of a technology. Venkatesh et al. (2003) went on to posit that four of the constructs would play a significant role in determining user acceptance and behavior. These include performance expectancy, effort expectancy, social influence and facilitating conditions. The questionnaire contains four items for each of the four constructs.

The model also measures three constructs that Venkatesh et al. (2003) theorized were important, but would not prove to be significant factors in predicting behavioral intention or usage of technology. These include self-efficacy, anxiety and attitude. There are four questions for each of these constructs included on the survey instrument. As illustrated on the UTAUT model, and as is consistent with the underlying theories the make up the model, Venkatesh et al. (2003) posited that behavioral intention would be a significant factor in predicting usage. The survey instrument contains three questions designed to measure behavioral intention. The UTAUT survey can be reviewed in Appendix A, C, and D.

The model takes into account four moderators that may impact the constructs in predicting behavioral intention and ultimately, usage. These moderators are gender, age, work experience, and voluntariness of use. Respondents were asked their gender, age, and work experience at the beginning of the questionnaire.

A seven-point Likert scale was used for all questions except the "facilitating conditions" items. Venkatesh et al.'s (2003) original instrument used a seven-point scale. The Likert scale consisted of the range: strongly agree to strongly disagree. The four facilitating condition questions also included "do not know". The

questionnaire was completed as soon as possible following initial training on a new technology. Therefore it was conceivable that the respondents would not know or have experience with the type of support that was available for the new technology. Since all questions were coded as mandatory and the respondent could not complete the survey unless all questions were filled in, it was necessary to account for this issue.

The majority of the respondents were sent an e-mail that included the link to the web-based survey shortly after completion of initial training of a new technology implementation. A minimal number of recipients were mailed a paper survey, as described below. Recipients were informed that the purpose of the survey was to understand their intention to use the new technology being implemented at their institution and that leadership in their organization supported their participation. The introduction to the survey also included information about confidentiality, approximate completion time, and contact information if there were questions.

### 4.6.2 Pilot Research

The purpose of the pilot was to test both the SNA and UTAUT aspects of the questionnaire for understandability, organization, and timing. The pilot survey was administered to nineteen (of twenty-one) members of the Information Technologies department at Beta College on Tuesday, June 13th, 2006. See Appendix A for the pilot instrument. An orientation to the pilot was provided that included an overview of the research, an explanation of its purpose, and assurance that the data submitted would be confidential in that no names would be published, only aggregate information.

A ten minute demonstration of the pilot scenario, a Wausau Benefits web-based claim-form process, was provided. This scenario was applicable to almost the entire group. A question was received from a staff member who does not use Wausau Benefits. She was asked that for this exercise to pretend that she would use this form in her job. The pilot group was then asked to fill out the survey and to think of the Wausau Benefits online claim process as something that they would use in their job. They were asked to use the back page as a place to keep track of questions they

found confusing, anything they did not understand how to do, and any other general comments on the process.

Staff members asked how to fill out the last two questions in the demographic section, about attending the briefing and training. They were told that the demo served as both. Another staff member asked if they were to complete the network analysis section and he was told to complete that section. Through observation, the estimated completion time of the technology acceptance section was about ten minutes. It took the pilot group between eighteen and thirty-five minutes to complete the entire survey. Based on the results of the survey, the answer ranges of two of the questions in the SNA section were changed and additional instructions were added to the SNA section in that the previous directions were confusing to a number of participants.

### 4.6.3 Survey Administration

Alpha University

Alpha University began their FMS implementation in the spring of 2006. The original research plan was to administer the survey, as done in the pilot, as a combined technology acceptance and social network questionnaire. Due to the timing of the FMS training and other implementation issues, it was determined that the SNA survey would be administered in September 2006 followed by the technology acceptance portion at a later date.

Also, based on advice from Martin Everett, an experienced social network analyst, the SNA questions were reduced from seven to four (Everett, 2006). Fewer questions addressed the concern that individuals would not take the time to complete seven questions on one hundred fifty-five (155) of their co-workers. Also, respondents might not understand the difference between the communication, innovation, problem solving, access, and engagement questions. In reviewing the research propositions and overall goal of the project, it was determined that the communication, innovation, social, and problem solving questions would meet the needs of the research. The frequency distributions were revised based on feedback

from the pilot survey. They were simplified in order to reduce confusion. The revised questions are listed below.

**Q1. Communication:** How often do you communicate with this person regarding work and what is going on at the Alpha University?

1 = Never
2 = Annually
3 = Quarterly
4 = Monthly
5 = Every two weeks
6 = Weekly
7 = Daily

**Q2. Innovation:** How often are you likely to turn to this person in order to discuss a new or innovative idea or business process?

1 = Never
2 = Annually
3 = Quarterly
4 = Monthly
5 = Every two weeks
6 = Weekly
7 = Daily

**Q3. Social:** How often do you see this person socially, for informal activities such as going out to lunch, dinner, drinks, and/or meeting outside of work?

1 = Never
2 = Annually
3 = Quarterly
4 = Monthly
5 = Every two weeks
6 = Weekly
7 = Daily

**Q4. Problem Solving:** This person is an important source of professional advice. I approach this person if I have a work-related problem or when I want advice on a decision I have to make.

1 = Strongly Disagree
2 = Disagree
3 = Somewhat Disagree
4 = Neutral
5 = Somewhat Agree
6 = Agree
7 = Strongly Agree

See Appendix B for the Alpha University SNA survey instrument that has been coded and referenced.

The SNA survey instrument was delivered to 156 staff members via university paper mail at the end of August 2006. Completion of the surveys was completely voluntary and after several e-mail reminders, 83 surveys were returned. Over the course of the next few months, several individuals left the university and duplicates were found on the list resulting in a sample size of 152 with 85 usable surveys for a return rate of 56%.

The Technology Acceptance survey was administered over two time periods. In February 2007, fourteen paper surveys were distributed via University mail to individuals who had recently received training on the FMS software. Follow-up e-mails were sent to encourage completion. Six surveys were completed. See appendix C for the survey instrument.

The second delivery of the technology acceptance survey was administered via the web using the QuestionPro web-based survey tool starting the week of June 25, 2007. One question was added to the original survey by request from Alpha University. This question, "How many hours per week do you expect that the use of the FMS will save on your current workload?", was intended to provide the University with feedback on a key result indicator specific to their FMS implementation. Answers included: save more than 10 hours, save 4 to 10 hours, save 1 to 4 hours, will not save time, add 1 to 4 hours, add 4 to 10 hours, add more than 10 hours, and do not know. A total of ninety-seven UTAUT surveys were completed. Fifty-seven individuals completed both the SNA and the UTAUT surveys.

Saints College

The Saints College survey was slightly modified from the survey administered to Alpha University. Based on the analysis done with the social network data from Alpha University, it was determined that the social network questions would be reduced from four to two. It was found that respondents to the Alpha University survey thoroughly completed the first two questions, but then entered very little data in the third and fourth question. Many respondents left question three and four blank. It is unknown whether this was due to the sensitivity of the questions or the time involved in completing the survey.

The purpose of eliminating two questions was to improve response rate since the survey would take less time to complete. The two questions determined by the researcher to be most applicable to technology acceptance were communication and innovation. The frequency distributions were not changed. The two questions included on the Saints College survey were:

- How often do you talk with this person regarding work and what is going on in the organization?
- How often are you likely to turn to this person in order to discuss a new or innovative idea or business process?

The Technology Acceptance section of the survey remained the same except for the elimination of the last question that was included only at the request of Alpha University. Reference Appendix D for the Saints College survey. Members of the sample received e-mails from the Saints College project lead immediately after the document imaging training requesting that they complete the web-based survey located on the QuestionPro website.

Follow-up e-mails were distributed periodically over the next month to encourage participation. The original social network included on the survey included all twenty-five staff from Saints College fundraising office. It was later determined that the entire staff did not receive training on the document imaging software, so the boundary of the sample was revised to include only the sixteen individuals who attended the training (Robins et al., 2004).

Midwest University

The Midwest University survey was identical to the Saints College survey except that the technology acceptance questions were modified to reflect their business intelligence reporting project instead of document imaging. Midwest University's social network boundary consisted of forty-four members of the implementation team who received an orientation on the business intelligence technology.

Immediately after the May 2007 orientation, an e-mail was sent to forty-four staff members that made up the sample by the University's Chief Information Officer. The e-mail requested members to complete the web-based survey located on the QuestionPro website.

### 4.6.4 Data Analysis

The data from each sample was analyzed in several ways in order to better understand the relationship of social capital and technology acceptance in the context of higher education organizations. The technology acceptance data was analyzed using statistical models consistent with previous UTAUT research. The social network data was analyzed using a number of standard centrality measures

commonly used in social network analysis. The technology acceptance and social network results were analyzed to explore the connections between social capital and technology acceptance.

The UTAUT model consists of eight independent latent variables, Performance Expectancy (PE), Effort Expectancy (EE), Social Influence (SI), Facilitating Conditions (FC), Anxiety (AN), Attitude (AT), Self-Efficacy (SE), and Behavioral Intent (BI). The model consists of two dependent variables, Behavioral Intent (BI) and Use (U). As outlined in Figure 4.1, the model also includes four key moderators: Gender, Age, Experience, Voluntariness of Use. All constructs except gender, age, and experience, were analyzed as ordinal values. This research focused on the social influence independent variable and the behavioral intention dependent variable.

The first step in the data analysis was to compare the results of this research with prior UTAUT research. Due to the small sample sizes, Structural Equation Modeling (SEM) was not used. The rule of thumb is ten cases per variable. Ten variables would require one hundred cases to effectively use SEM (Chang et al., 2007). None of the samples included in this research contained more than one hundred cases.

Several questions that were worded negatively were re-coded so that all questions could be analyzed on the same ordinal scale. Also, the four facilitating conditions questions (32-35) were re-coded in order to omit the "do not know" answer. Table 4.5 outlines the recoding changes.

The technology acceptance data was analyzed using the SPSS statistical software package, version 15 (SPSS_Inc., 2006a). SPSS is the standard statistical analysis software tool that was available to the researcher. SPSS was able to accommodate the types of analysis required for this research.

| Question | Question Text |
|---|---|
| **3** | *Negative:* It scares me to think that I could lose a lot of information using the FMS by hitting the wrong key |
| **9** | *Negative:* The FMS is somewhat intimidating to me |
| **13** | *Negative:* I could complete a job or task using the FMS only if I could call someone for help if I got stuck |
| **16** | *Negative:* Although it might be helpful, using the FMS is certainly not compulsory in my job |
| **18** | *Negative:* I feel apprehensive about using the FMS |
| **26** | *Negative:* I hesitate to use the FMS for fear of making mistakes I cannot correct |
| **27** | *Negative:* My boss does not require me to use the FMS |
| **28** | *Negative:* I could complete a job or task using the FMS if I had a lot of time |
| **32** | *Negative and do not know:* The FMS is not compatible with other systems I use |
| **33** | *Do not know:* I have the knowledge necessary to use the FMS system |
| **34** | *Do not know:* A specific person (or group) is available for assistance with difficulties using the FMS system |
| **35** | *Do not know:* I have the resources necessary to use the FMS system |

Table 4.5: Re-coded Survey Questions

Scales were created for each variable by computing the mean for the set of questions associated with each scale. See Appendix E for the list of questions that make up each scale. In order to ensure the reliability of the instrument, Cronbach's Alpha was calculated and each variable was evaluated based on standards that Cronbach's Alpha be greater than .7 (Chang et al., 2007, Carlsson et al., 2006, Garson, 2007, Han et al., 2004, Louho et al., 2006). Cronbach's Alpha is the most common form of internal consistency reliability coefficient. It is based on the average correlation among the survey's responses (Garson, 2007). Replicability and reliability are key characteristics for quantitative, positivist research.

Factor analysis was used to validate that the questions used for each latent, independent variable form a valid construct. Factor analysis is an analysis tool that reduces the number of variables into a smaller number of dimensions or clusters (Allison, 1999, Mertler and Vannatta, 2005, Reese and Lochmuller, 1994). Factor

analysis detects structure in relationships in order to classify or categorize the variables (StatSoft, 2007a).

The factor extraction mathematical model determines the extent of shared variance among each set of variables in order to determine that these variables are, in fact, measuring something in common (Mertler and Vannatta, 2005). Specifically, this research employed principal component analysis which takes into account unique, shared, and error variability to determine variance for each variable. In this research, the hope would be that the three to four questions that compose each independent variable in the UTAUT model be classified into eight groups.

Multivariate or multiple regression was used to examine the relationships between the various constructs of the UTAUT model and to test the associated hypothesis consistent with prior research (Carlsson et al., 2006, Han et al., 2004, Louho et al., 2006). The dependent factor was behavioral intention and the independent factors were the other seven independent variables (PE, EE, SI, FC, AN, AT, and SE). Regression is linear in nature and produces three types of information (Mertler and Vannatta, 2005). The first is the model summary table which describes how well the independent variables predict the dependent variable. The second section is the ANOVA table which looks at the degree to which the relationship is linear. Lastly, the coefficients tables which includes the tolerance coefficient which measures the degree to which each independent variable accounts for the unique variance of the dependent variable. If tolerance is less than .1, the regression analysis should be redone excluding that particular independent variable.

There are several limitations of multiple regression analysis. First, regression provides relationships, but not cause (StatSoft, 2007b). This research will take this into account when analyzing the data. Second, Multicollinearity is another problem that needs to be taken into account. Multicollinearity occurs when moderate to high inter-correlations exist among independent variables so that they are measuring the same relationship and causes problems with interpretation of the data (Mertler and Vannatta, 2005). There are two forms of multicollinearity: extreme and near-extreme (Allison, 1999). Extreme multicollinearity occurs when two independent variables in a regression equation result in a perfectly related linear function. The

problem with this is that the researcher cannot determine the relationship between independent variable A and the dependent variable and between independent variable B and the dependent variable. Extreme multicollinearity is unusual in the social sciences and usually occurs because of the way the independent variables are formulated (Allison, 1999). It is fairly easy to identify extreme multicollinearity because it actually prevents calculation of regression coefficients when using statistical tools like SPSS.

The more common instance of multicollinearity is near-extreme (Allison, 1999). It is harder to identify and can cause a researcher to misinterpret data. Near-extreme multicollinearity is defined as a strongly related linear function between two independent variables. Near-extreme multicollinearity occurs when the correlation is close to 1 or -1, the closer the correlation, the greater the problems (Allison, 1999, Licht, 1995). An $R^2$ above .60 should cause the researcher concern (Allison, 1999). Near-extreme multicollinearity may result in a lack of statistically significant coefficients as well as counter-intuitive results. Overall, multicollinearity occurs most often in time-series data or aggregated, group data. This research does not fall in those categories. Also, multicollinearity is minimized when the goal is prediction, which is the desired outcome of this research. Multicollinearity will be tested for and discussed in Chapter five.

Lastly, results can be manipulated by the type of multiple regression used: standard, hierarchical or stepwise (Mertler and Vannatta, 2005). Standard multiple regression analyzes all variables at the same time. Each independent variable is analyzed on the dependent variable as if it had been entered into the equation last and evaluated as to what it adds to the prediction of the dependent variable (Mertler and Vannatta, 2005).

Hierarchical multiple regression consists of a series of simultaneous analyses of the variables using the same criterion with the first analysis containing one or more predictors, the next adds one or more, and so on (Licht, 1995). The variables are taken in order, therefore the order is significant. Hierarchical analysis is used to calculate semi-partial correlations.

Stepwise multiple regression can either be forward inclusion or backward elimination (Licht, 1995). Forward inclusion is similar to the hierarchical method, however the order is not important, in that the independent variables are taken in order of greatest relationship with the dependent variable. Backward elimination includes all variables in the first analysis and then removes variables for each subsequent analysis (Licht, 1995). In hierarchical analysis, the researcher determines the number and order of variables based on theory, whereas in stepwise analysis, the regression terminates when additional variables no longer significantly increases the $R^2$.

It is important that the correct model is selected for analysis. Both hierarchical and stepwise approaches have an advantage over standard in that one variable is added at a time and is continually monitored for significant improvement of prediction of the dependent variable. Hierarchical regression should be used if the researcher has specific theories upon which to base the order of the variables. Stepwise regression should be used if exploration is the purpose of that particular analysis (Mertler and Vannatta, 2005).

This data consists almost entirely of ordinal scales which theoretically, as Allison (1999: 10) states "are inappropriate for multiple regression because the linear equation, to be meaningful, requires information on the magnitude of changes." However, this research will use regression analysis because there are no other acceptable alternatives and it is accepted practice in IS research (Allison, 1999).

In summary, the technology acceptance data received comparable analysis as previous research. By performing the same analysis, this research is not only validated, but draws conclusions and connections based on the findings of previous studies. The results of this research on a sample from higher education is also an addition to the existing body of knowledge in this area.

## 4.7 Communities of Practice

This section focuses on the data collection and analysis methods used in the Community of Practice aspect of this research and the identification of individuals with high social capital to inform its membership (Figure 4.11).

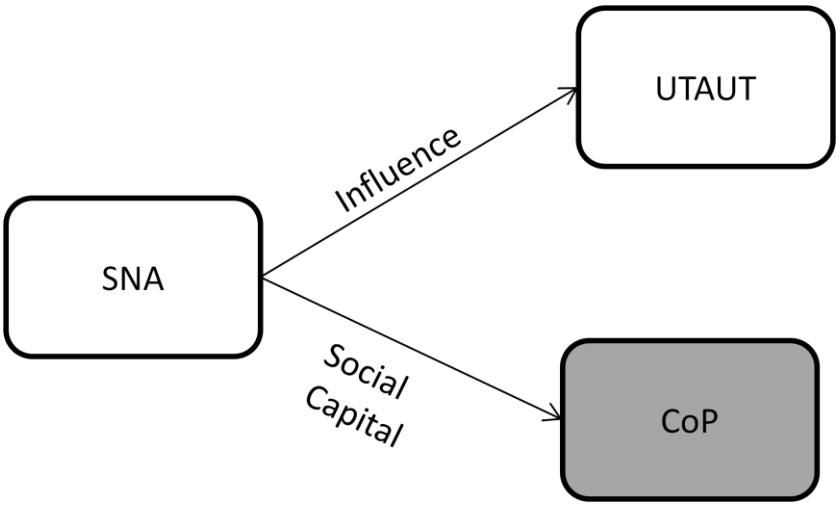


Figure 4.11: Communities of Practice

### 4.7.1 Data Collection: Interviews

The Action Case approach was used for the Community of Practice aspect of this research. The first phase, diagnosing, occurred at the organization. The FMS implementation project leaders determined that they needed a way to better communicate information and process as related to the implementation. In other words, they needed a social structure with effective communication channels in order to diffuse the new technology into Alpha University. The project leadership agreed to support a social network analysis of the staff who would be using the new Finance Management System in order to inform the action they would take. This process made up phase two of the action case. The research produced a list of staff and their associated departments and centrality scores. The project leadership decided to nurture a Community of Practice made up of staff with high social capital whose role would be to support the technology implementation. Project leadership reviewed their options and invited individuals to join the CoP as phase three, action taking.

The fourth phase of action research is evaluating. This method of data collection for the evaluation was interview and will be discussed more thoroughly in the next paragraphs. The interviews were followed by phase five, specifying learning, in the form of data analysis of the interview transcripts and an intervention made to improve the technology implementation. The data analysis will be discussed in the next section.

The data collection method for the evaluation phase of the action case is interviews. One-on-one interviews were conducted to gain further insight into the use of individuals with high social capital in a technology implementation process. A semi-structured interview approach was taken that consisted of a set of standard questions for each interview, allowing for the opportunity for follow-up questions intended to clarify issues and allow the researcher to delve into interesting areas (Punch, 1998, Domholdt, 2005). A digital tape-recorder was used to record the interviews as is standard for open-ended interviews (Punch, 1998).

Interviews are one of the main data collection tools for qualitative research (Punch, 1998). The advantages of personal interviews are that the researcher can dig deeper into the situation than with questionnaires. It is also possible to clarify questions and answers to ensure understanding. The disadvantages of interviews are that they are very time consuming in both the gathering, documenting and analysis of the data (Domholdt, 2005). Interviews are also open to misinterpretation due to vocabulary and misunderstandings (Punch, 1998).

The following questions were asked to each interviewee. Follow-up questions were asked, as appropriate, to gain further insight.

- What role has this CoP played in the FMS project and the implementation of the FMS? (Zboralski et al., 2006, Wenger, 2007a)
- Were the right people selected for the CoP?
- 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?
- What could have been done differently to make the implementation even more successful?
- What do you see as the future role of the CoP?
- Do you have any other observations or feedback as to what worked well and what did not work so well as pertains to the CoP role in the FMS implementation?

### 4.7.2 Data Analysis

The interviews were digitally recorded and archived into .wav files. The interviews were analyzed and common themes were identified. These common themes and ideas were coded using SPSS Text Analyzer and analyzed (SPSS_Inc., 2006b). This research follows standard interpretive, qualitative interview processes. Interview data is situational and must be analyzed from an interpretive perspective in that it reflects an individual's perspective on their particular situation at a point-in-time.

Difficulties in analyzing interview data include interview bias in which the interviewer interprets the interviews from their personal perspectives (Punch, 1998). Additional concerns with the validity of responses are the accuracy of people's memories, self-deception, dishonesty, and social acceptability (Punch, 1998). These concerns can be addressed through careful interview design, planning, and training (Punch, 1998). The interview questions were designed carefully from the literature and the interviewer was not a member of the organization which addresses concerns of bias.

## 4.8 Summary

This chapter reviewed epistemologies and alternative ways of knowing. It went on to justify a hybrid approach using multiple research methodologies. The chapter justifies the use of a positivist, quantitative approach to the social capital and technology aspects of the research as well as an interpretive, qualitative approach to the Community of Practice proposition. In addition, this chapter outlines the

research design by introducing the three case organizations, presenting the data collection instruments, and summarizing the data analysis methods needed for each proposition. The next chapter will summarize the data and present the findings based on the methodologies described in this chapter.

# 5. Findings

> *"We provided empirical and theoretical support for the use of managerial interventions, such as training and communication, to influence acceptance of technology, since perceived usefulness and ease of use contribute to behavioral intention to use the technology"*(Amoako-Gyampah and Salam, 2004: 731).

## 5.1 Introduction

This chapter presents the findings from this research. The overview section will include a summary of the three cases to include demographic descriptives. The following section summarizes the analysis conducted to add to the UTAUT research base (Venkatesh et al., 2003). Standard statistical analysis was performed to better understand the technology acceptance data and the affect of the independent variables (UTAUT constructs) on the dependent variable (Behavioral Intention).

The findings from the three aspects of this research are then discussed. This chapter will include the identification of individuals with social capital that are used in the two propositions of this research. To analyze Proposition 1, "Is social capital, as identified through SNA, a stronger predictor of Behavioral Intention than the Social Influence construct of the UTAUT model?", the findings for the two hypotheses are presented.

## 5.2 UTAUT Model Overview

### 5.2.1 Descriptives

This section provides a summary of the average demographic variables for each case organization (Table 5.1) as well as an overview of demographics that influence the social influence construct of the UTAUT model. The gender demographics represent males as the number one and females as the number two. Experience is

measured in years and Voluntariness of Use is measured with a 7-point Likert scale ranging from strongly agree (1) to strongly disagree (7).

| | Saints College | Midwest University | Alpha University |
|---|---|---|---|
| **Age** | 46.92 | 45.51 | 41.72 |
| **Gender** | 1.93 | 1.63 | 1.71 |
| **Experience** | 10.43 | 9.84 | 7.14 |
| **Voluntariness Of Use** | 2.98 | 3.43 | 2.85 |

Table 5.1: Demographic Descriptives

Fifteen complete surveys were received from Saints College out of the sixteen possible resulting in a response rate of 94%. Of the fifteen, fourteen were female (93%) and one was male (7%). The average age was 47 with ages ranging from 25 to 61. The average years experience working at Saints College was 10.4 with years worked ranging from ½ year to 22 years.

Thirty-eight completed surveys were received from Midwest University. Two individuals left the university during the survey period reducing the sample size of forty-four to forty-two, resulting in a response rate of 90%. Of the responses, fourteen were male (37%) and twenty-three were female (63%). The average age was 46 with ages ranging from 26-65. The average years experience working at Midwest University was 9.8 with years worked ranging from 1 to 30 years.

Ninety-six completed technology acceptance surveys were received from Alpha University. Thirty-two were from individuals not in the original social network. The fifty-seven received from the original population resulted in a 37% response rate from the original 152 social network members. Of the ninety-six, sixty-eight were female (71%) and twenty-eight male (29%). The average age was 42 with ages ranging from 19 to 63. The average years experience working at Alpha University was 7.1 with years worked ranging from less than a year to 35 years.

Of interest when looking at social influence is gender, age, experience and voluntariness of use. These moderators have been found to be stronger predictors of BI through SI in women, particularly older women, in mandatory settings, and in

early stages of experience (Venkatesh et al., 2003). All three samples have a high percentage of older workers, women, and experienced workers (Table 5.2).

| | **45 years old or older** | **Women** | **5 or more years Experience** |
|---|---|---|---|
| **Saints College** | 77% | 93% | 73% |
| **Midwest University** | 59% | 63% | 71% |
| **Alpha University** | 43% | 71% | 54% |

Table 5.2: Social Influence Moderators

The independent and dependent variable scales were created by averaging the responses to the appropriate questions as prescribed in the UTAUT model (Venkatesh et al., 2003). Descriptives of the UTAUT Constructs (Mean of scale / standard deviation) are outlined in Table 5.3.

| **Average / Std Dev** | **Saints College** | **Midwest University** | **Alpha University** |
|---|---|---|---|
| Behavioral Intention | 1.47 / .485 | 2.23 / 1.306 | 1.39 / .559 |
| Performance Expectancy | 2.87 / .850 | 3.22 / 1.027 | 3.64 / 1.150 |
| Effort Expectancy | 2.37 / .725 | 3.51 / 1.146 | 3.24 / 1.252 |
| Social Influence | 2.12 / .743 | 2.93 / .922 | 2.55 / .982 |
| Facilitating Conditions | 2.10 / .706 | 3.96 / 1.366 | 4.54 / .974 |
| Anxiety | 3.17 / 1.493 | 3.14 / 1.162 | 3.10 / 1.233 |
| Attitude | 2.57 / .691 | 3.88 / .707 | 3.61 / 1.346 |
| Self-Efficacy | 3.78 / .674 | 3.89 / .815 | 3.67 / .916 |

Table 5.3: UTAUT Scales and Standard Deviations

### 5.2.2 Instrument reliability

The technology acceptance aspect of the data analysis looked at the three case organizations in this research in relationship to Venkatesh et al.'s (2003) UTAUT model. SPSS ver. 15.0 was used to analyze the data (SPSS_Inc., 2006a). To validate the reliability of the questionnaire in a higher education context, Cronbach's Alpha and Factor Analysis were performed on the two larger data sets, Midwest University and Alpha University (see Table 6.1). The Saints College data set was too small for this analysis to be significant.

Cronbach's Alpha was used to measure internal consistency reliability (Table 5.4). Cronbach's Alpha was calculated for each variable and was determined to be

reliable if greater than 0.7 (Chang et al., 2007, Garson, 2007, Han et al., 2004, Carlsson et al., 2006, Louho et al., 2006). The highlighted constructs did not exceed 0.7. Social Influence is the measure of most interest to this research. It is very near to 0.7 and considered close enough to proceed with the research.

| **Cronbach's Alpha** | **Midwest University** | **Alpha University** |
|---|---|---|
| Behavioral Intention | .936 | .843 |
| Performance Expectancy | .763 | .756 |
| Effort Expectancy | .896 | .879 |
| Social Influence | **.625** | **.641** |
| Facilitating Conditions | **.551** | **.681** |
| Anxiety | .769 | .777 |
| Attitude | .849 | .912 |
| Self-Efficacy | **.413** | **.401** |
| Voluntariness | **.263** | **.470** |

Table 5.4: Cronbach's Alpha

A factor analysis was completed using the 35 questions for the two universities. Tables 5.5 and 5.6 are the resulting factor analysis tables by coded variable. Again, the Saints College's sample was too small for this type of analysis. The "Rotated Component Matrix" was reviewed. The components did not fall out cleanly into the independent and dependent constructs as prescribed in the UTAUT model for either Alpha University or Midwest University. The components, as specified in the UTAUT model, were used in this research, however, for correlation and regression analysis due to the fact that the UTAUT model is an established model and previous attempts to validate the model have been successful.

| | Component | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| AN1recode | .126 | .851 | .026 | .037 | .123 | -.107 | .118 | -.069 |
| AN2recode | .066 | .579 | .032 | .561 | .161 | -.051 | .238 | -.223 |
| AN3recode | .084 | .453 | .247 | .730 | .172 | .113 | -.042 | .194 |
| AN4recode | .137 | .850 | -.087 | .182 | -.140 | .091 | .171 | .084 |
| AT1 | .504 | .465 | .016 | .264 | .552 | .247 | .127 | .069 |
| AT2 | .344 | .750 | .230 | .093 | -.050 | .020 | -.265 | -.132 |
| AT3 | .400 | .686 | .419 | -.180 | .212 | .112 | -.142 | -.044 |
| AT4 | .441 | .528 | .486 | -.120 | .250 | .093 | -.115 | -.117 |
| BI1 | .848 | .117 | .205 | .042 | .247 | .090 | -.059 | .141 |
| BI2 | .848 | .231 | .023 | -.033 | -.079 | -.093 | .327 | .128 |
| BI3 | .876 | .132 | .186 | -.027 | .075 | .106 | .039 | .127 |
| EE1 | .344 | .456 | .346 | .543 | .182 | .003 | .210 | .145 |
| EE2 | .381 | .474 | .652 | -.080 | -.103 | .129 | .141 | .181 |
| EE3 | .261 | .706 | .502 | .227 | .118 | .043 | -.085 | -.034 |
| EE4 | .577 | .495 | .547 | .058 | .051 | .118 | .080 | -.038 |
| FC1recode | .220 | .091 | .884 | .028 | .022 | .184 | .142 | .060 |
| FC2recode | .296 | .089 | .882 | -.003 | .079 | .144 | .035 | -.087 |
| FC3recode | .084 | .001 | -.239 | .852 | -.077 | .173 | -.079 | .103 |
| FC4recode | .033 | .055 | .356 | -.239 | .389 | .137 | .698 | .146 |
| PE1 | .816 | .234 | .322 | .069 | -.183 | -.078 | .178 | .081 |
| PE2 | .820 | .128 | .174 | .273 | .186 | .088 | -.263 | -.043 |
| PE3 | .825 | .203 | .021 | .074 | .151 | .262 | .018 | .049 |
| PE4 | -.030 | .485 | -.126 | -.555 | .230 | .435 | .044 | .271 |
| SE1 | .327 | .644 | .376 | .041 | -.044 | .228 | .083 | -.029 |
| SE2recode | .211 | -.052 | .226 | .095 | -.071 | .822 | .179 | -.106 |
| SE3recode | -.043 | .094 | .053 | .106 | .064 | .214 | .789 | -.038 |
| SE4 | .148 | .138 | .478 | .092 | .246 | .620 | .180 | .159 |
| SI1 | .698 | .205 | .352 | .006 | -.002 | .103 | -.198 | .155 |
| SI2 | .701 | .235 | .300 | .062 | -.144 | -.054 | -.085 | .325 |
| SI3 | -.029 | .404 | .376 | .140 | .424 | .514 | .216 | .212 |
| SI4 | .320 | .070 | .111 | .128 | .851 | .179 | .040 | -.004 |
| VU1recode | .329 | -.172 | -.107 | .018 | -.035 | -.014 | .015 | .862 |
| VU2recode | .520 | -.051 | .239 | .161 | .022 | .053 | .062 | .663 |
| VU3 | .670 | .193 | .061 | .265 | .000 | .217 | -.328 | .395 |
| VU4 | -.324 | -.067 | -.044 | -.192 | .666 | -.265 | .308 | -.127 |

Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization. a Rotation converged in 14 iterations.

Table 5.5: Midwest University - Factor Analysis

| | Component | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| AN1recode | .162 | .204 | -.186 | .874 | .025 | .063 | -.028 | -.062 | .096 |
| AN2recode | -.154 | .075 | -.319 | .413 | .392 | .162 | .216 | -.283 | .023 |
| AN3recode | .170 | .166 | -.072 | .563 | .383 | .190 | .129 | .018 | .505 |
| AN4recode | -.092 | .081 | -.069 | .855 | .068 | -.084 | -.157 | .037 | -.063 |
| AT1 | .856 | .083 | .071 | .050 | .066 | .040 | -.128 | -.067 | .058 |
| AT2 | .892 | .060 | .081 | -.031 | .137 | .078 | .113 | -.026 | .106 |
| AT3 | .836 | .151 | .111 | .047 | .145 | .175 | .060 | .032 | -.139 |
| AT4 | .896 | .110 | .026 | .202 | .011 | .065 | -.026 | .109 | -.030 |
| BI1 | .041 | -.010 | .172 | .080 | .907 | -.036 | .076 | -.019 | -.025 |
| BI2 | .084 | -.032 | .390 | .073 | .427 | -.558 | .220 | .144 | .085 |
| BI3 | .251 | -.100 | .324 | .090 | .806 | .051 | -.197 | -.019 | .033 |
| EE1 | .685 | .319 | .132 | .215 | -.114 | .157 | -.136 | .137 | .293 |
| EE2 | .300 | .571 | .029 | .566 | -.060 | -.139 | .148 | -.070 | -.206 |
| EE3 | .829 | .279 | -.121 | .293 | -.050 | -.034 | .045 | -.020 | -.066 |
| EE4 | .402 | .622 | .014 | .411 | .018 | -.032 | .207 | -.094 | -.247 |
| FC1recode | .262 | .844 | -.055 | .050 | -.058 | .070 | .035 | .062 | .106 |
| FC2recode | .172 | .830 | -.059 | .232 | -.046 | .155 | .176 | -.035 | -.023 |
| FC3recode | .464 | .075 | -.072 | -.146 | .313 | .499 | .212 | .060 | -.074 |
| FC4recode | .084 | .733 | -.142 | -.115 | .039 | -.086 | -.107 | .174 | .236 |
| PE1 | .539 | -.092 | .371 | -.236 | .070 | .109 | .436 | .215 | .204 |
| PE2 | .842 | .116 | .101 | -.064 | .018 | .199 | .020 | .111 | .102 |
| PE3 | .862 | .113 | .018 | -.076 | .073 | -.007 | .164 | .069 | .100 |
| PE4 | .036 | .183 | .150 | -.024 | -.019 | -.032 | .810 | .100 | .163 |
| SE1 | .183 | .595 | .276 | .371 | -.001 | .193 | -.027 | -.128 | -.052 |
| SE2recode | -.090 | .410 | -.008 | .456 | .286 | .133 | .121 | -.109 | -.422 |
| SE3recode | .260 | -.129 | .134 | .285 | .076 | .544 | .366 | .014 | -.099 |
| SE4 | .111 | .082 | .100 | -.021 | .002 | -.038 | .174 | .021 | .833 |
| SI1 | .077 | .015 | .645 | .083 | .096 | -.204 | -.203 | .474 | -.054 |
| SI2 | .097 | -.062 | .571 | -.098 | .164 | -.086 | .391 | .512 | .044 |
| SI3 | .605 | .093 | -.133 | -.346 | -.123 | -.047 | -.039 | .395 | .012 |
| SI4 | .205 | .061 | -.052 | -.057 | -.101 | .346 | .209 | .770 | .075 |
| VU1recode | .146 | -.065 | .849 | -.176 | .100 | .082 | .089 | -.167 | .070 |
| VU2recode | .036 | -.103 | .842 | -.048 | .186 | -.052 | -.056 | -.077 | .000 |
| VU3 | -.059 | .114 | .695 | -.054 | .026 | -.003 | .327 | .072 | .052 |
| VU4 | .237 | .196 | -.042 | .012 | .015 | .721 | -.129 | .193 | .075 |

Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization. a Rotation converged in 12 iterations.

Table 5.6: Alpha University - Factor Analysis

### 5.2.3 Correlations

Bi-variate correlation analysis was performed to identify significant correlations between the independent variables and the dependent variable to both understand the cases studied and validate the original UTAUT model. Saints College resulted in

only one significant correlation out of sixteen relationships (Figure 5.1). Gender seems to have a negative relationship on Social Influence. The lack of correlation could be attributed to the small sample size and the homogeneity of the population.

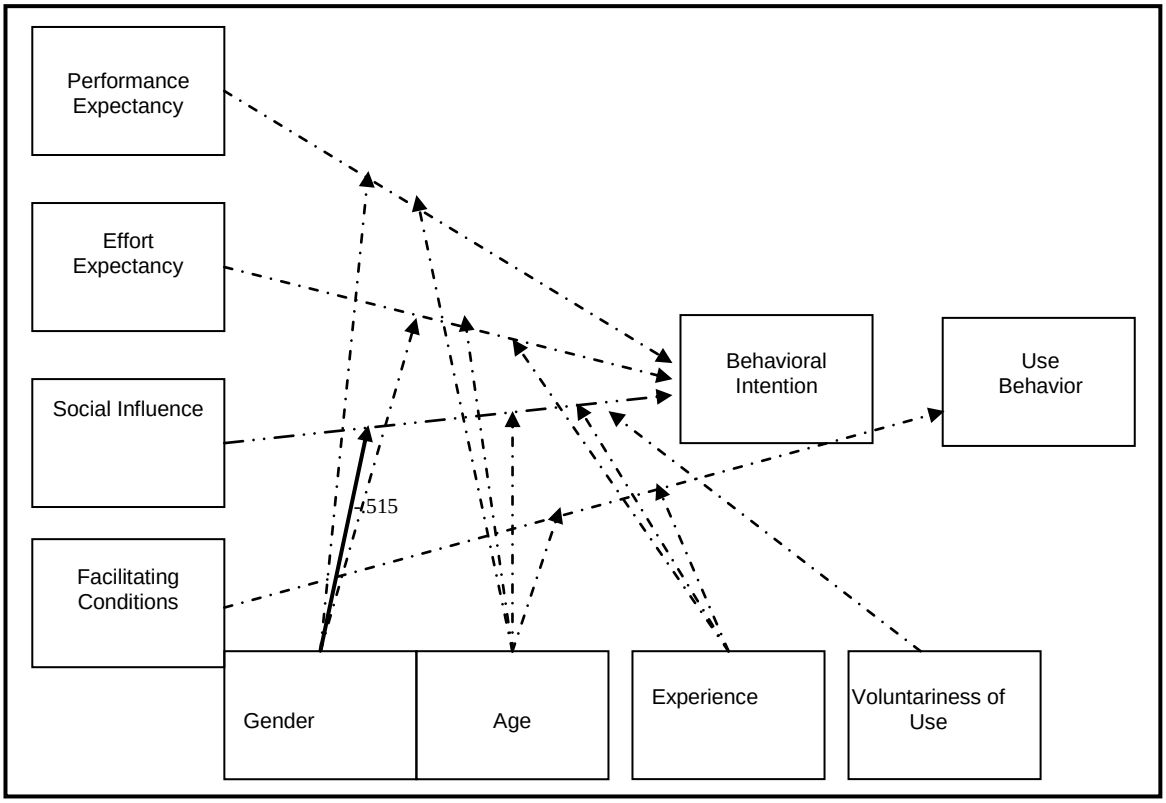


Figure 5.1: Saints College UTAUT Results

Midwest University resulted in significant correlations in five of the sixteen relationships as defined by the original UTAUT model (Figure 5.2) (Venkatesh et al., 2003). The high correlation of .712 between SI and BI at the level of $p < .01$ illustrates an $r^2$ of .51 or that about 50% of the variability in behavioral intention can be attributed to social influence (Domholdt, 2005). The strongest correlation in the Midwest University data set was between PE and BI resulting in an $r^2$ of .75 or 75% of variability in behavioral intention can be attributed to Performance Expectancy. Table 5.7 summarizes the Pearson Correlations of all variables and moderators.

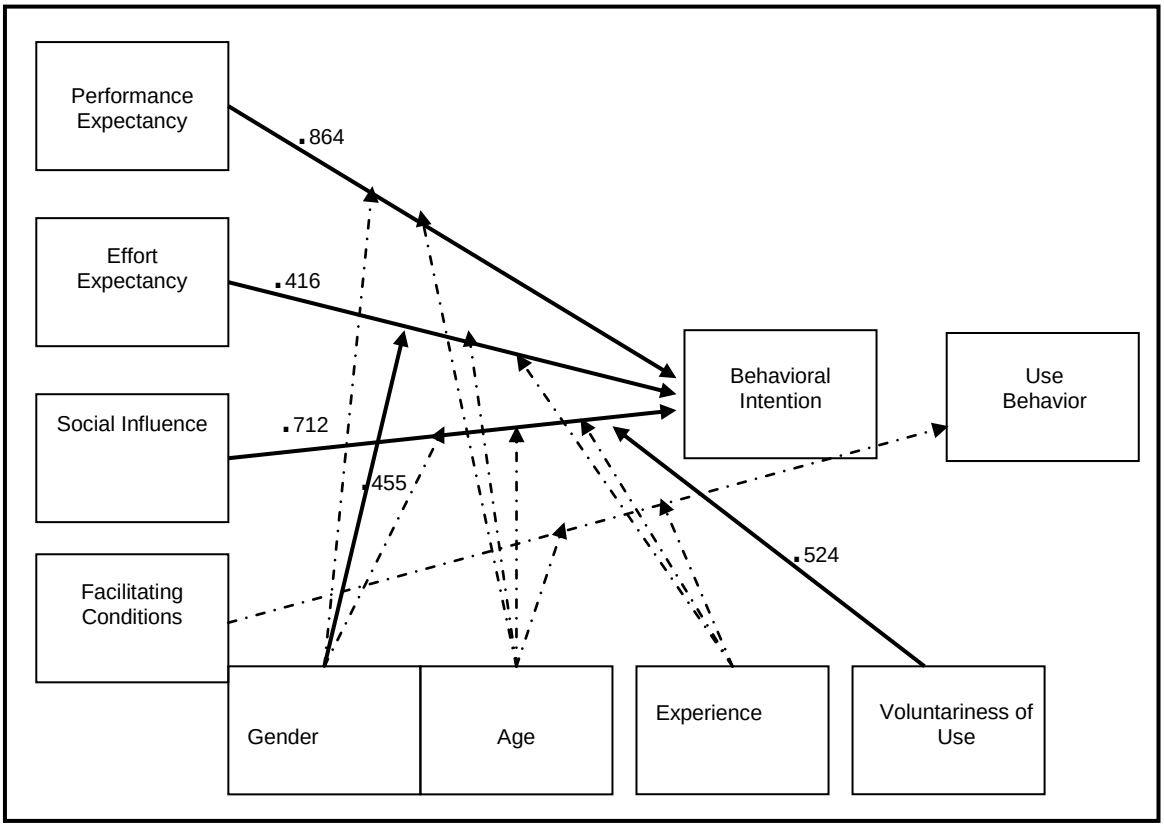


Figure 5.2: Midwest University UTAUT Results

Alpha University results represent all 96 valid cases and show significant correlations in only three of the sixteen relationships as defined by the original UTAUT model (Figure 5.3) (Venkatesh et al., 2003). A strong correlation exists in the Alpha University data set between SI and BI resulting in an $r^2$ of only .08 or a small 8% of variability in behavioral intention can be attributed to social influence. The PE to BI relationship indicated an $r^2$ of only .07 or a small 7% of variability in BI can be attributed to PE. Table 5.8 summarizes the Pearson Correlations of all variables and moderators.

Multicollinearity was tested for both institutions. Two collinearity statistics were measured: tolerance and VIF (Tables 5.9 and 5.10). Tolerance values range from 0 to 1 where a value near 0 may indicate that collinearity exists. A value of 0.1 or less is cause for concern. None of the tolerance values in either university were less than 0.1 (Mertler and Vannatta, 2005). The Variance Inflation Factor (VIF) indicates whether or not a strong linear relationship exists between an independent variable and all others. A VIF of greater than 10 is an indicator of collinearity (Mertler and Vannatta, 2005). Again, neither university received a VIF of greater than 10.

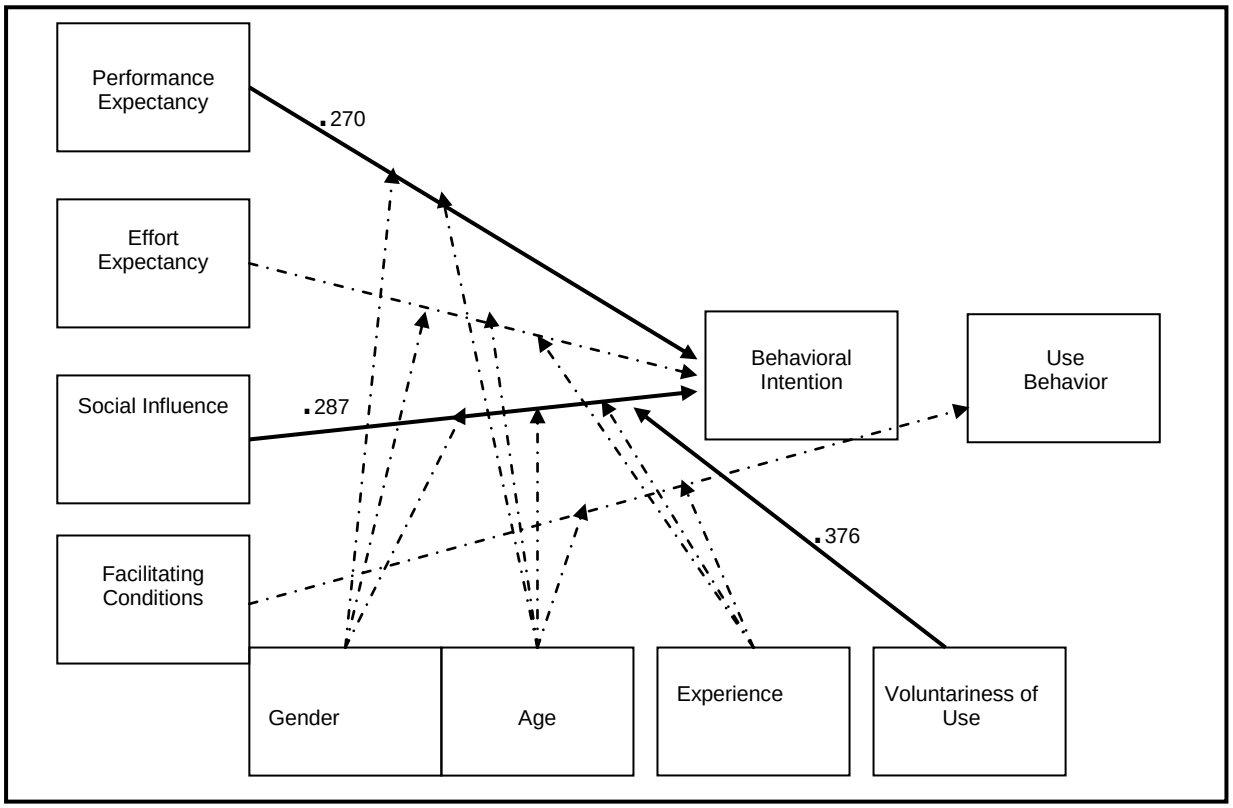


Figure 5.3: Alpha University UTAUT Results

| Midwest University | BI | PE | EE | SI | AN | AT | FC | SE | VU | Age | Gender |
|---|---|---|---|---|---|---|---|---|---|---|---|
| PE | .864(**) | | | | | | | | | | |
| EE | .416(**) | .511(**) | | | | | | | | | |
| SI | .712(**) | .811(**) | .637(**) | | | | | | | | |
| AN | .228 | .324(*) | .628(**) | .388(*) | | | | | | | |
| AT | .329(*) | .392(*) | .661(**) | .464(**) | .126 | | | | | | |
| FC | .258 | .368(*) | .668(**) | .584(**) | .434(**) | .439(**) | | | | | |
| SE | .285 | .353(*) | .553(**) | .480(**) | .453(**) | .295 | .524(**) | | | | |
| VU | .635(**) | .534(**) | .247 | .524(**) | .099 | .082 | .204 | .141 | | | |
| Age | -.033 | .060 | .139 | .003 | .346(*) | .077 | .119 | .220 | .046 | | |
| Gender | .177 | .204 | .455(**) | .275 | .453(**) | .470(**) | .540(**) | .386(*) | .006 | .376(*) | |
| Experience | -.083 | .054 | -.073 | -.007 | -.094 | .039 | .099 | .051 | .008 | .443(**) | .211 |

** Correlation is significant at the 0.01 level (2-tailed). * Correlation is significant at the 0.05 level (2-tailed).

Table 5.7: Midwest University Pearson Correlations

| Alpha University | BI | PE | EE | SI | AN | AT | FC | SE | VU | Age | Gender |
|---|---|---|---|---|---|---|---|---|---|---|---|
| PE | .270(**) | | | | | | | | | | |
| EE | .189 | .612(**) | | | | | | | | | |
| SI | .287(**) | .402(**) | .302(**) | | | | | | | | |
| AN | .121 | .023 | .405(**) | -.101 | | | | | | | |
| AT | .276(**) | .781(**) | .747(**) | .405(**) | .178 | | | | | | |
| FC | .140 | .524(**) | .656(**) | .283(**) | .134 | .508(**) | | | | | |
| SE | .209(*) | .364(**) | .607(**) | .158 | .460(**) | .451(**) | .461(**) | | | | |
| VU | .376(**) | .235(*) | .006 | .294(**) | -.184 | .143 | .126 | .003 | | | |
| Age | .032 | .078 | .176 | .022 | -.010 | .223(*) | -.119 | .187 | -.133 | | |
| Gender | -.087 | -.038 | -.007 | .005 | .036 | -.009 | -.077 | .077 | .103 | .048 | |
| Experience | .135 | .178 | .074 | .091 | -.106 | .093 | .042 | .044 | .117 | .402(**) | -.048 |

** Correlation is significant at the 0.01 level (2-tailed). * Correlation is significant at the 0.05 level (2-tailed).

Table 5.8: Alpha University Pearson Correlations

| Model | | Unstandardized Coefficients | | Standardized Coefficients | | | Collinearity Statistics | |
|---|---|---|---|---|---|---|---|---|
| | | B | Std. Error | Beta | t | Sig. | Tolerance | VIF |
| 1 | (Constant) | -1.903 | 1.075 | | -1.770 | .090 | | |
| | PEmean | .966 | .192 | .767 | 5.031 | .000 | .307 | 3.258 |
| | EEmean | -.052 | .225 | -.047 | -.230 | .820 | .172 | 5.816 |
| | SImean | .098 | .282 | .069 | .349 | .730 | .185 | 5.409 |
| | ANmean | -.082 | .170 | -.075 | -.486 | .632 | .297 | 3.371 |
| | ATmean | -.047 | .281 | -.026 | -.167 | .869 | .295 | 3.394 |
| | FCmean | -.121 | .127 | -.128 | -.956 | .349 | .398 | 2.515 |
| | SEmean | .016 | .175 | .010 | .091 | .928 | .561 | 1.784 |
| | VUmean | .357 | .196 | .206 | 1.821 | .082 | .561 | 1.784 |
| | Age | -.003 | .014 | -.026 | -.236 | .816 | .585 | 1.710 |
| | Gender | .565 | .336 | .211 | 1.682 | .106 | .453 | 2.206 |
| | Experience | -.022 | .016 | -.147 | -1.406 | .173 | .656 | 1.523 |

Dependent Variable: BImean

Table 5.9: Midwest University – Multicollinearity Test

| Model | | Unstandardized Coefficients | | Standardized Coefficients | | . | Collinearity Statistics | |
|---|---|---|---|---|---|---|---|---|
| | | B | Std. Error | Beta | t | Sig | Tolerance | VIF |
| 1 | (Constant) | .908 | .589 | | 1.541 | .131 | | |
| | PEmean | -.012 | .100 | -.027 | -.125 | .901 | .354 | 2.829 |
| | EEmean | -.088 | .105 | -.220 | -.845 | .403 | .253 | 3.952 |
| | SImean | .073 | .097 | .130 | .754 | .455 | .576 | 1.736 |
| | ANmean | .153 | .074 | .369 | 2.077 | .044 | .546 | 1.831 |
| | ATmean | .104 | .089 | .290 | 1.171 | .248 | .279 | 3.578 |
| | FCMean | -.117 | .100 | -.253 | -1.167 | .250 | .365 | 2.740 |
| | SEmean | .034 | .108 | .060 | .311 | .757 | .466 | 2.146 |
| | VUmean | .196 | .088 | .335 | 2.227 | .031 | .761 | 1.314 |
| | Age | -.006 | .009 | -.110 | -.670 | .507 | .638 | 1.569 |
| | Gender | -.125 | .156 | -.111 | -.802 | .427 | .902 | 1.108 |
| | Experience | -.006 | .013 | -.068 | -.456 | .651 | .785 | 1.274 |

Dependent Variable: BImean

Table 5.10: Alpha University – Multicollinearity Test

### 5.2.4 Regression

Multiple regression was conducted to determine the significance of the independent variables (Performance Expectancy, Effort Expectancy, and Social Influence). Behavioral Intention is the dependent variable. Standard Regression was performed allowing the appropriate independent variable into the model regardless of

significant contribution (Mertler and Vannatta, 2005). Regression analysis was not done on Saints College due to the small sample size.

Regression results for Midwest University indicate that almost 75% of the variance in Behavioral Intention was accounted for by PE, EE, and SI. A summary of regression results is presented in Table 5.11 and indicates that PE is the strongest construct with EE and SI adding minimally to the equation. The Anova table indicates that the model predicts Behavioral Intention with a low residual value and a significance of .000 which is less than 0.05 (SPSS_Inc., 2006a). The coefficient table indicates the relative importance of PE and the unimportance of EE and SI. PE has a t value well above +2 which indicates significance (Mertler and Vannatta, 2005).

**Variables Entered/Removed[b]**

| Model | Variables Entered | Variables Removed | Method |
|---|---|---|---|
| 1 | SImean, EEmean, PEmean[a] | . | Enter |

a. All requested variables entered.

b. Dependent Variable: BImean

**Model Summary**

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|---|---|---|---|---|
| 1 | .865[a] | .748 | .726 | .684 |

a. Predictors: (Constant), SImean, EEmean, PEmean

**ANOVA[b]**

| Model | | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|---|
| 1 | Regression | 47.235 | 3 | 15.745 | 33.670 | .000[a] |
| | Residual | 15.899 | 34 | .468 | | |
| | Total | 63.135 | 37 | | | |

a. Predictors: (Constant), SImean, EEmean, PEmean

b. Dependent Variable: BImean

**Coefficients[a]**

| Model | | Unstandardized Coefficients | | Standardized Coefficients | t | Sig. |
|---|---|---|---|---|---|---|
| | | B | Std. Error | Beta | | |
| 1 | (Constant) | -1.259 | .418 | | -3.010 | .005 |
| | PEmean | 1.062 | .187 | .835 | 5.677 | .000 |
| | EEmean | -.063 | .127 | -.055 | -.497 | .622 |
| | SImean | .099 | .232 | .070 | .427 | .672 |

a. Dependent Variable: BImean

Table 5.11: Summary of Midwest University Regression Results

Regression results for Alpha University indicate that only 11% of the variance in behavioral intention was accounted for by PE, EE, and SI combined. A summary of regression results is presented in Table 5.12 and indicates that SI is the strongest construct with EE and PE adding minimally to the equation. The Anova table indicates that the model does not predict Behavioral Intention. The residual sum of squares for all independent variables is much higher than the regression sum. A significance of .012 is greater than 0.05 which indicates the model does not explain the variation of behavioral intention (SPSS_Inc., 2006a). The Coefficient table indicates the relative unimportance of all independent variables as they are all less than +2 or greater than -2 (Mertler and Vannatta, 2005).

**Variables Entered/Removed[b]**

| Model | Variables Entered | Variables Removed | Method |
|---|---|---|---|
| 1 | SImean, EEmean, PEmean[a] | . | Enter |

a. All requested variables entered.

b. Dependent Variable: BImean

**Model Summary**

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|---|---|---|---|---|
| 1 | .334[a] | .111 | .082 | .53568 |

a. Predictors: (Constant), SImean, EEmean, PEmean

**ANOVA[b]**

| Model | | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|---|
| 1 | Regression | 3.304 | 3 | 1.101 | 3.838 | .012[a] |
| | Residual | 26.399 | 92 | .287 | | |
| | Total | 29.704 | 95 | | | |

a. Predictors: (Constant), SImean, EEmean, PEmean

b. Dependent Variable: BImean

**Coefficients[a]**

| Model | | Unstandardized Coefficients | | Standardized Coefficients | t | Sig. |
|---|---|---|---|---|---|---|
| | | B | Std. Error | Beta | | |
| 1 | (Constant) | .747 | .203 | | 3.684 | .000 |
| | PEmean | .085 | .063 | .174 | 1.339 | .184 |
| | EEmean | .008 | .056 | .019 | .151 | .880 |
| | SImean | .120 | .061 | .211 | 1.964 | .053 |

a. Dependent Variable: BImean

Table 5.12: Summary of Alpha University Regression Results

The mixed results from the two cases will be discussed in Chapter seven. The results of the technology acceptance UTAUT surveys were summarized and presented to each organization with suggestions as to the types of interventions leadership could undertake to meet the needs of their organization as identified in the survey results (Appendix F).

## 5.3 Social Capital

This section provides a high-level overview of the social network analysis conducted to identify individuals with social capital. The social capital findings were used as a foundation for both propositions in this research. The social network data was analyzed using a combination of UCINET and NetDraw software (Borgatti et al., 2002). Three centrality measures, in-degree, betweenness, and closeness, as discussed in Chapter two, were performed for each data set. 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 individuals

who are key in the communication network of an organization and who others perceive as prestigious, trustworthy and popular (Wasserman and Faust, 1995).

The following diagrams illustrate, in graphical form, the informal communication and innovation networks of the three higher education organizations used in this research. This type of analysis often shows a much different network structure than an organization's formal hierarchical chart (Cross and Parker, 2004). Social network analysis often reveals individuals who are critical to information flow that were previously unknown to organizational leaders. They can also illustrate how one person can control the flow of information to a whole section of an organization causing leaders to think about contingency plans if that individual were to leave the company. Also, they can enlighten organizational leaders as to individuals who may not be meeting the communication expectations of their position, as well as whole sections of the organization who may be cut off from the rest of the company (Cross and Parker, 2004).

The following figures outline interactions that occur at least every two weeks among the individuals of each university for each question. The thickness of the lines represent frequency of contacts and the size of the nodes represent the individuals in-degree centrality measure.

These social network diagrams provide insight into each case organization's social network. The location and size of the node as well as the thickness of the lines identifies central individuals who may possess a high degree of social capital. This knowledge is used both in proposition 1 to better understand the role of social influence in determining behavioral intention to use a new technology as well as in proposition 2 when identifying members to participate in a Community of Practice to support a technology implementation.

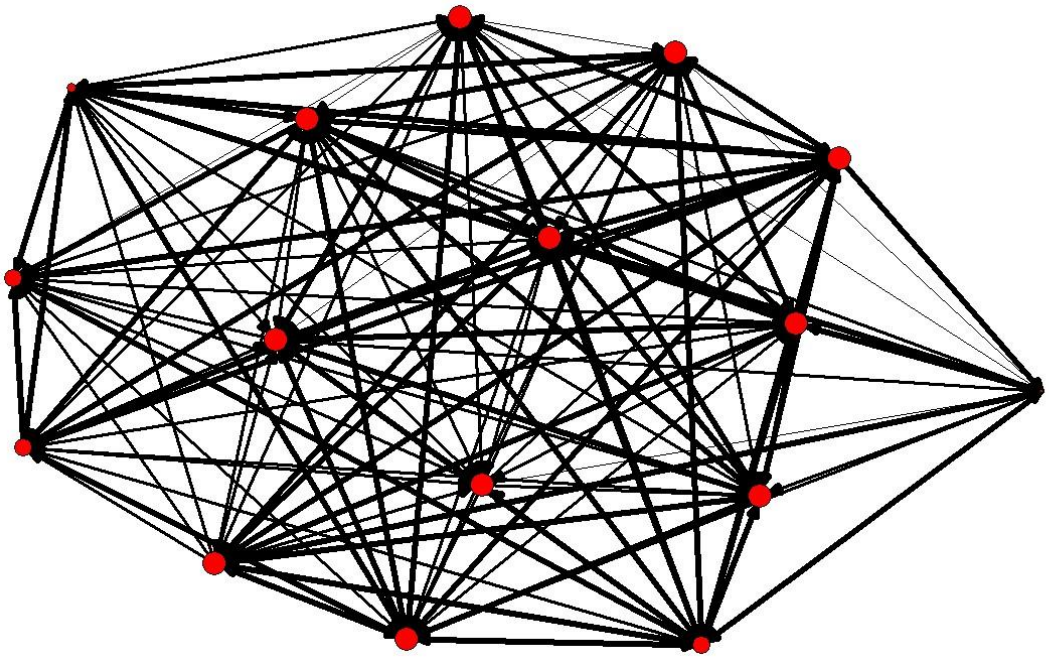

Figure 5.4: Saints College, Question 1. How often do you talk with this person regarding work and what is going on in the organization?

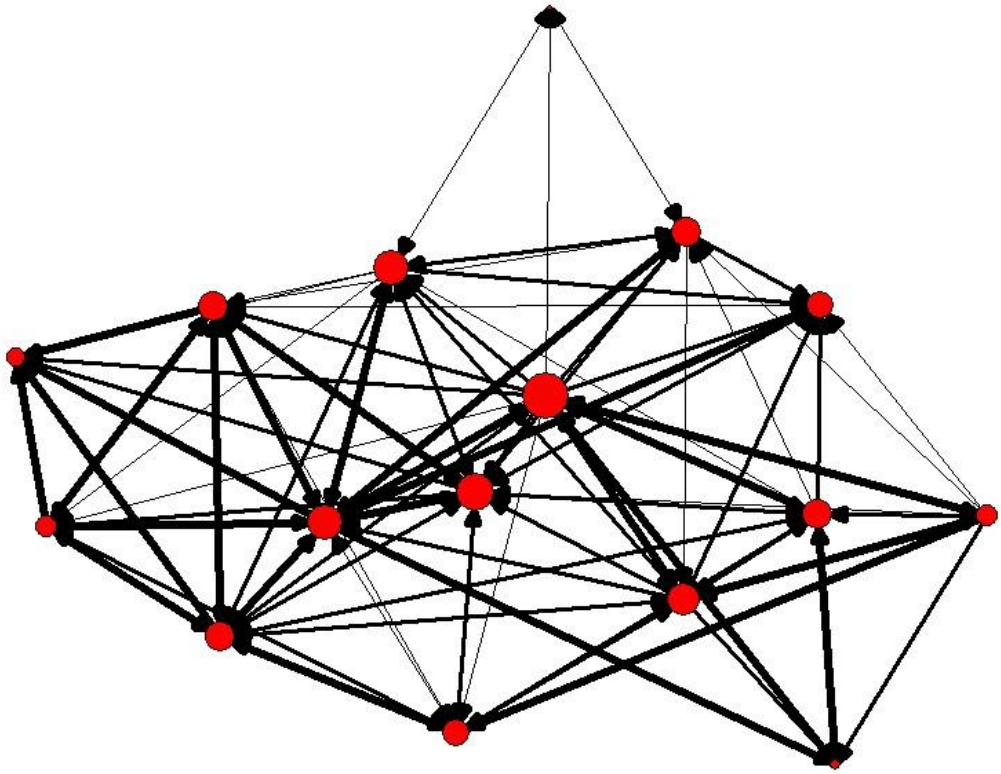

Figure 5.5: Saints College, Question 2. How often are you likely to turn to this person in order to discuss a new or innovative idea or business process?

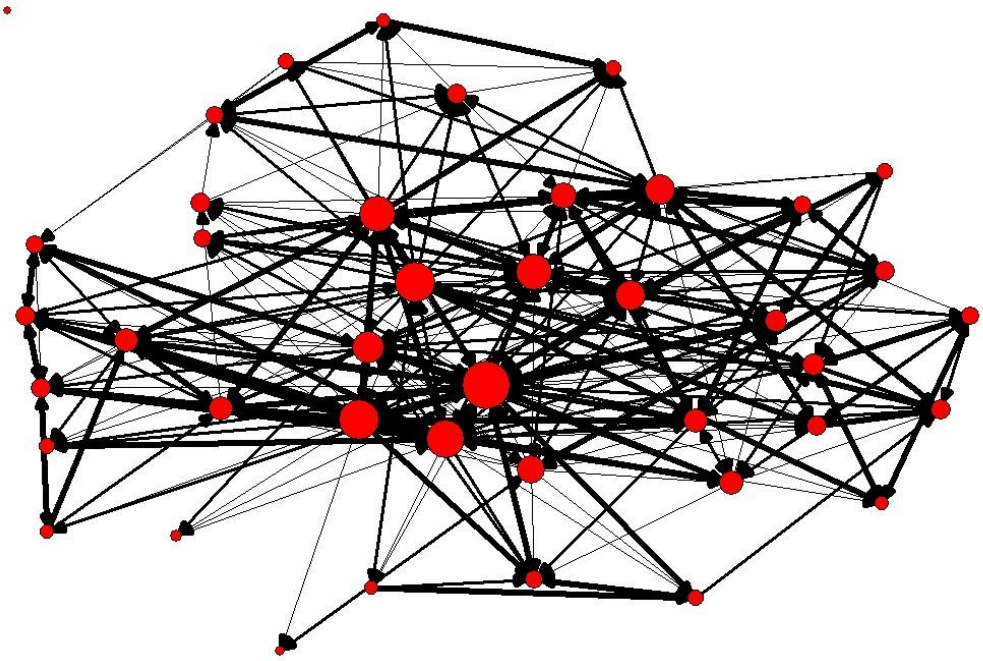

Figure 5.6: Midwest University, Question 1. How often do you talk with this person regarding work and what is going on in the organization?

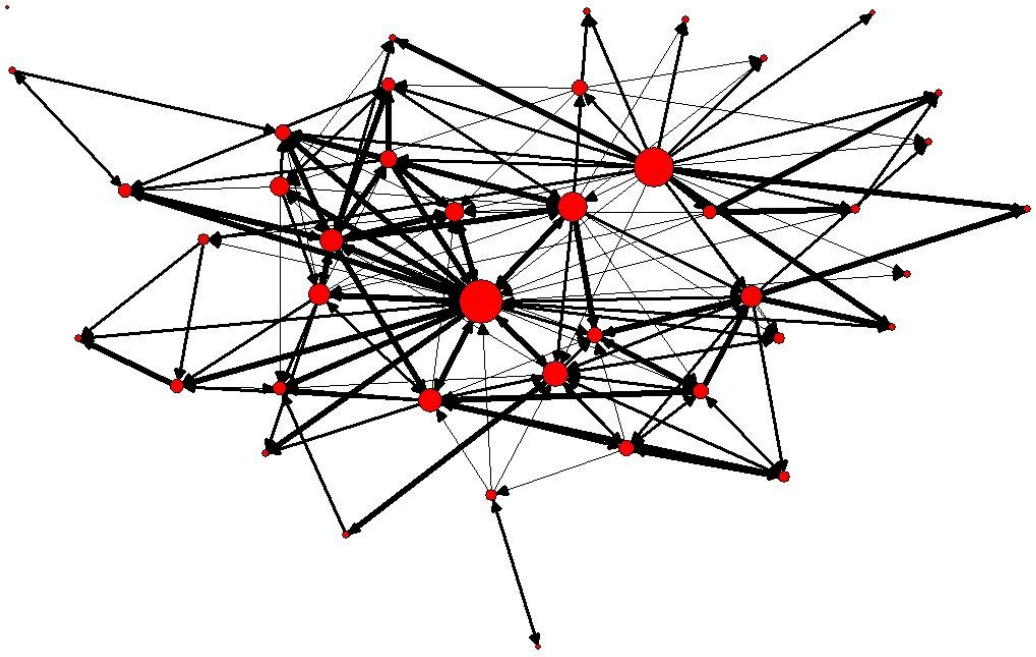

Figure 5.7: Midwest University, Question 2. How often are you likely to turn to this person in order to discuss a new or innovative idea or business process?

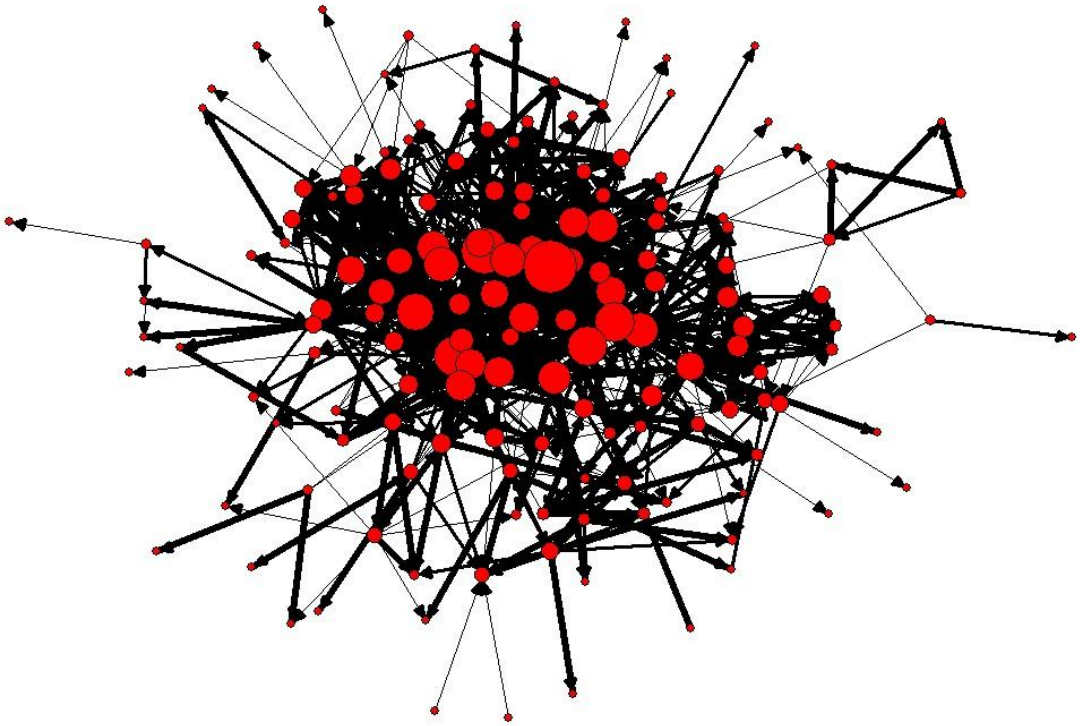

Figure 5.8: Alpha University, Question 1. How often do you talk with this person regarding work and what is going on in the organization?

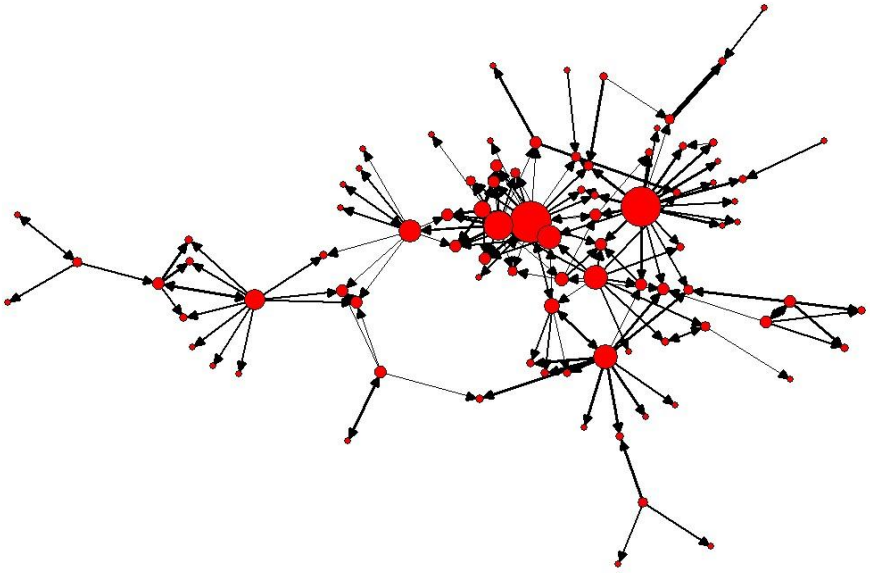

Figure 5.9: Alpha University, Question 2. How often are you likely to turn to this person in order to discuss a new or innovative idea or business process?

The diagrams also provide an illustration of communication channels that could facilitate or hinder information flow. Figure 5.9, for instance, provides an excellent example of where one person seems to control information flow to the entire left side of the social network. This information is of interest to technology

implementers in general, and specifically, to this researcher when reflecting on the membership of the CoP whose main role is communication to support a technology implementation.

Figure 5.4 illustrates the homogeneity of the Saints College's social network. At first glance, it is easy to see that all the nodes are the same size indicating that all individuals communicate with each other. There are only a couple of nodes that indicate less contact with others in their department.

Lastly, the social network diagrams highlight the differences between communication patterns, question 1, and innovation patterns, question 2. A quick glance at the difference between the two questions shows that peoples' patterns of general communication are much different from how they discuss new or innovative ideas. The difference between Figures 5.6 and 5.7 is a good illustration of the difference in relationships, both in the frequency of contact (the lines) and in the number of contacts/in-degree centrality measures (the nodes).

These network diagrams provide the foundation for the two propositions of this research. They illustrate the social networks of each organization and the social capital residing there. They are insightful, valuable images of the different communication patterns and relationships that exist in each organization's social network. The next section will go into more depth as to how social capital measures were used in proposition 1 and the findings of the data analysis.

## 5.4 Proposition 1: Social Capital and Technology Acceptance

The purpose of this section is to present the findings from the data analysis conducted for Proposition 1, "Is social capital, as identified through SNA, a stronger predictor of Behavioral Intention than the Social Influence construct of the UTAUT model?" Proposition 1 consists of two hypotheses. The next two sections will outline the findings for each hypothesis.

### 5.4.1 Hypothesis 1: Social Capital

Hypothesis 1 posits that social capital will correlate with Behavioral Intention (BI). The expectation is that the higher an individual's social capital in an organization, the greater their intent to use the new technology. Tables 5.13 and 5.14 contain the social capital descriptives for Midwest University and Alpha University.

Centrality measures were correlated with individual behavioral intention to explore the relationship between a person's social capital or centrality in the network and their intent to use the new technology in the UTAUT model. In-degree, flow betweenness, and closeness measures for question one and two were added together to create social capital constructs for each individual in the Alpha University and Midwest University data sets. The Alpha University data set for proposition 1 consists of 57 cases, or those individuals who completed both the UTAUT and the Social Network surveys.

| Midwest University | Minimum | Maximum | Mean | Std. Deviation |
|---|---|---|---|---|
| q1indegree | 21.254 | 57.143 | 37.13539 | 9.667105 |
| q2indegree | 12.892 | 40.767 | 23.61084 | 7.254932 |
| indegree sum | 35.888 | 97.910 | 60.74624 | 16.404918 |
| q1flow | 1.221 | 5.551 | 2.55045 | .950395 |
| q2flow | .000 | 3.087 | 1.69350 | .829898 |
| flow sum | 1.221 | 8.201 | 4.24395 | 1.390632 |
| q1close | 89.130 | 100.000 | 99.22416 | 2.208142 |
| q2close | 78.846 | 100.000 | 96.50976 | 6.372249 |
| close_sum | 176.364 | 200.000 | 195.73392 | 7.557444 |

Table 5.13: Midwest University's Descriptives of Social Capital Constructs

| Alpha University | Minimum | Maximum | Mean | Std. Deviation |
|---|---|---|---|---|
| q1indegree | 2.717 | 19.544 | 9.30396 | 4.499394 |
| q2indegree | .954 | 6.566 | 2.70932 | 1.369081 |
| indegree sum | 3.671 | 25.043 | 12.01328 | 5.733913 |
| q1flow | .000 | 6.560 | 1.12351 | 1.693865 |
| q2flow | .000 | 3.895 | .66328 | .873461 |
| flow sum | .000 | 9.772 | 1.78679 | 2.341181 |
| q1close | 52.751 | 94.220 | 68.38956 | 15.105250 |
| q2close | 52.258 | 94.737 | 64.57321 | 14.232930 |
| Close_sum | 105.009 | 188.957 | 132.96277 | 27.554475 |

Table 5.14: Alpha University's Descriptives of Social Capital Constructs

Bi-variate Correlation analysis was performed to identify significant correlations between the independent variables (in-degree, flow betweenness, closeness) and the dependent variable (behavioral intention). This analysis is displayed in Tables 5.15 and 5.16. The only significant correlations were between the independent variables or the centrality measures. No significant correlations occurred between behavioral intention and the independent variables at either institution.

| **Midwest University** | **Correlations** | Behavioral Intention | Indegree | Flow Betweenness |
|---|---|---|---|---|
| Indegree | Pearson Correlation<br>Sig. (2-tailed)<br>N | -.039<br>.818<br>38 | | |
| Flow Betweenness | Pearson Correlation<br>Sig. (2-tailed)<br>N | -.178<br>.284<br>38 | .682(**)<br>.000<br>38 | |
| Closeness | Pearson Correlation<br>Sig. (2-tailed)<br>N | -.068<br>.685<br>38 | -.041<br>.807<br>38 | .400(*)<br>.013<br>38 |

** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

Table 5.15: Midwest University's Pearson Correlations Using Social Capital

| **Alpha University** | **Correlations** | Behavioral Intention | In-degree | Flow Betweenness |
|---|---|---|---|---|
| In-degree | Pearson Correlation<br>Sig. (2-tailed)<br>N | .022<br>.872<br>57 | | |
| Flow Betweenness | Pearson Correlation<br>Sig. (2-tailed)<br>N | -.232<br>.083<br>57 | .565(**)<br>.000<br>57 | |
| Closeness | Pearson Correlation<br>Sig. (2-tailed)<br>N | -.226<br>.090<br>57 | .612(**)<br>.000<br>57 | .666(**)<br>.000<br>57 |

** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

Table 5.16: Alpha University's Pearson Correlations Using Social Capital

The regression results indicate that 5% of the variance in behavioral intention was accounted for by the social capital constructs for Midwest University and 12% for Alpha University. Comparing the variance in BI using social capital measures with the original SI construct produced mixed results (Table 5.17). Midwest University resulted in a lower predictability than the original SI construct 5%, much lower than the original 51%. Whereas, Alpha University resulted in 12% variance, better than the original 3%. This will be reflected on in Chapter seven and indicates the need for further research into H1.

| BI = dependent variable<br><br>$R^2$ | Sum of Indegree, flow betweenness, closeness | Original SI |
|---|---|---|
| Midwest University | .049 | .507 |
| Alpha University | .121 | .033 |

Table 5.17: Social Capital Regression Analysis

*Note: $R^2$ is different for Alpha University than presented in section 5.2.3 due to the fact that this table's data set only included those cases that completed both the UTAUT and the SNA surveys.*

### 5.4.2 Hypothesis 2: Social Influence

Hypothesis 2 posits that individuals with high social capital influence others and their intent to use a new technology. Three closeness measures were performed on the social network data of the Alpha University and Midwest University data sets: Taylor, Edge Betweenness, and Friedkin measures. Table 5.18 describes each method and the type of influence it measures.

| **Method** | **Definition** | **What it measures** |
|---|---|---|
| Taylor | A measure of closeness that takes into account all connections of an individual to all others. (Hanneman and Riddle, 2005). | Influence of actors |
| Edge Betweenness | A measure of closeness that looks at relationships rather than people. It measures a relation that is part of the geodesic between pairs of actors (Hanneman and Riddle, 2005). | Influence of relationships |
| Friedkin | A measure that takes into account structural cohesion, centrality and similarity (Friedkin, 1993). | Influence of opinions of others |

Table 5.18: SNA Influence Measures

This research introduces a new social influence model for H2. First a closeness score is generated for each individual in each case. The individual measure is then weighted by multiplying an individual's closeness score by their BI scale to create an influence score. This weighted influence score represents a combination of an individual's intent to use a new technology with their social capital or influence in their social network. The goal of this measure is to find a relationship between an individual's BI in conjunction with their status in the network and the BI of those they influence.

The influence score of those connected to an individual were then averaged to create a "Social Capital Influence" construct designed to represent the overall Behavioral Intention of all individuals closest to a person. This Social Capital Influence construct was then substituted into the UTAUT model for the SI construct in order to analyze whether or not the Social Capital Influence construct would perform better than the SI construct as is posited in H2.

The following tables provide a step-by-step example of this new social capital construct model. Table 5.19.1 provides a sample closeness matrix listing individuals closeness scores as determined through SNA analysis. This example used the Taylor method and will follow Jane's scores through the process. Jane has a closeness score of 0.002 with John, -0.005 with person Joe, and so on. Table 5.19.2 shows a sample BI table containing individual BI scores as determined from the UTAUT survey. Jane's behavioral intent to use the new technology was a 2.

| **Taylor Closeness** | John | Jane | Joe | Jeff | Jerry |
|---|---|---|---|---|---|
| John | 0 | -0.002 | 0.003 | 0.022 | 0.003 |
| Jane | 0.002 | 0 | -0.005 | -0.034 | -0.002 |
| Joe | -0.003 | 0.005 | 0 | 0.021 | 0 |
| Jeff | -0.022 | 0.034 | -0.021 | 0 | -0.007 |
| Jerry | -0.003 | 0.002 | 0 | 0.007 | 0 |

Table 5.19.1: Sample Closeness Matrix

| ID | BI |
|---|---|
| John | 1 |
| Jane | 2 |
| Joe | 3 |
| Jeff | 4 |
| Jerry | 2 |

Table 5.19.2: Sample BI Table

Table 5.19.3 shows the weighted influence score that results from multiplying the closeness score with that individual's BI score for each cell in the matrix. Jane's weighted influence score is 0.002 with John because John's BI score is 1 * 0.002 = 0.002. Jane's weighted influence score changes for Joe as Joe's BI is 3, so the weighted influence score is -0.005 * 3 = -0.015. Table 5.19.4 contains the social capital influence constructs created through this example by averaging each person's weighted influence score. Jane's social capital construct is -0.03825 ((0.002 + -0.015 + -0.136 + -0.004) / 4)

| Taylor Closeness * BI | John | Jane | Joe | Jeff | Jerry |
|---|---|---|---|---|---|
| John | 0 | -0.004 | 0.009 | 0.088 | 0.006 |
| Jane | 0.002 | 0 | -0.015 | -0.136 | -0.004 |
| Joe | -0.003 | 0.01 | 0 | 0.084 | 0 |
| Jeff | -0.022 | 0.068 | -0.063 | 0 | -0.014 |
| Jerry | -0.003 | 0.004 | 0 | 0.028 | 0 |

Table 5.19.3: Sample Weighted Influence Score

| ID | Avg Weighted Influence |
|---|---|
| John | 0.02475 |
| Jane | -0.03825 |
| Joe | 0.02275 |
| Jeff | -0.00775 |
| Jerry | 0.00725 |

Table 5.19.4: Sample SNA Influence Constructs

The following table (5.20) is the result of the correlation analysis when the social capital influence construct replaces the social influence construct in the UTAUT model for Midwest and Alpha universities. One result indicates a significant

correlation, that being the Friedkin measure at Alpha University which resulted in a moderate correlation of .510 (Domholdt, 2005). No additional correlations were found at the 0.05 level (2-tailed) or the 0.1 level (2-tailed).

| **Influence Measure** | **Midwest University** | **Alpha University** |
|---|---|---|
| Line Betweenness (edge)*BI | .045 | .067 |
| Taylor*BI | -.029 | -.175 |
| Friedkin*BI | -.242 | -.510** |
| Original SI (UTAUT) | .712** | .183 |

**Correlation is significant at the 0.01 level (2-tailed).

Table 5.20: Influence Correlation Matrix

As with H1, the results of H2 are mixed. One significant finding is that the social capital influence construct using the Friedkin measure as the influence measure did result in a significant correlation. The Alpha University Friedkin measure indicates 26% of the variability in predicting behavioral intention can be attributed to this social capital influence construct compared with 3% when using the original SI construct. This finding is promising in that with additional research, a social capital influence construct may prove to be more effective in predicting BI than the original SI construct.

| BI = dependent variable<br><br>$R^2$ | Line Betweeness | Taylor | Friedkin | Original SI |
|---|---|---|---|---|
| Midwest University | .002 | .001 | .059 | .507 |
| Alpha University | .005 | .031 | **.260** | .033 |

Table 5.21: Social Capital Influence Regression Analysis

## 5.5 Summary

This chapter began with a summary of the descriptors for each case organization. Analysis was conducted on the technology acceptance data in order to add to the UTAUT body of knowledge and offer the findings from two case organizations to that research. This was followed by an overview of the social networks of each organization including diagrams of the communication and innovation networks. The social network analysis informed the social capital measures used for proposition 1 and the two associated hypotheses. The next two sections presented

the findings for H1 and H2. Results were mixed with a significant finding in each hypothesis. These positive findings indicate preliminary support for proposition 1 and the need for additional research in this area.

The next chapter builds on the social network analysis described in this chapter. Proposition 2 posits the use of social capital measures to inform membership in a CoP whose role is to support a technology implementation through the diffusion of technological innovation. Chapter 6 presents the findings of the interviews conducted in support of the evaluation phase of this action case as well as the outcome of the last phase of the action case, 'specifying learning'.

# 6. Communities of Practice Findings

> *"We believe that encouraging technology use mediation…within the community of practice that we hope to foster, may be essential process for adoption and assimilation"* (Davidson and Heslinga, 2007: 26)

## 6.1 Introduction

This chapter continues the presentation of the findings from this research by focusing on Proposition 2, "How can a Community of Practice comprised of individuals with high social capital be enrolled to support a technology implementation?" Interview data is presented and categorized with the intent of better understanding how social capital can be used to support a technology implementation at Alpha University.

## 6.2 Proposition 2: Social Capital to Support Technology Implementation

Social network data was used by Alpha University to identify potential members of a Community of Practice (CoP) that would support their FMS technology implementation. The in-degree, betweenness, and closeness measures were analyzed and a list of the most central people was presented to the project's leadership. These individuals possessed a certain degree of social capital and their centrality measures identified them as potential candidates to facilitate the diffusion of innovation. The leadership at Alpha University reviewed the lists of individuals with high social capital and were surprised at some of the individuals identified. Leadership felt that social capital in and of itself was not the only selection criteria for the CoP. Therefore, they took into account each person's social capital as well as their function in the organization, their department, and their interpersonal skills and personality. The FMS leadership team invited eight staff members from across the organization to form a CoP. The members of the CoP were told that their

purpose was to support the FMS implementation through communication and serving as a sounding board for the project's leadership.

In-degree scores for question 1 (communication) were important in the selection of the CoP membership. Table 6.1 lists the in-degree measures for question 1 by department for the members of the CoP. In-degree scores ranged from the highest in-degree being 261 to the lowest in-degree measure of 3. The higher the score the more incoming relationships that individual possesses. This table illustrates that just because an individual received the highest score, 261, they were not selected for the CoP. The table also illustrates the range of scores across departments and the FMS leadership's desire to gather individuals with high social capital from across the organization as well as their selectivity in finding the 'right' person who not only has social capital, but will hopefully also serve as a an unsung hero, not as a road block.

| Dept 1 | Dept 2 | Dept 3 | Dept 4 |
|---|---|---|---|
| 150 | 217 | 106 | 165 |
| 100 | 161 | | |
| 93 | | | |
| 77 | | | |

Table 6.1. Question 1, In-degree Measures by Department for Members of the CoP

The FMS leadership looked at the top centrality scores from three social capital measures. Table 6.2 lists the top twenty social capital measures as resulting from in-degree, closeness, and flow betweenness for question 1 where communication occurred at least every two weeks. Several individuals appeared in the top twenty of each list, examples are shaded such as individuals 89823, 89822, and 89828. Members of the CoP are indicated by bold print. This diagram illustrates the diversity of scores across measurements as well as the leadership's use of scores as only one criteria for selection of membership.

| ID | In-Degree | | ID | Closeness | | ID | Flow Betweenness |
|---|---|---|---|---|---|---|---|
| 89799 | 210 | | **89822** | **53.90** | | 89780 | 7.42 |
| 89805 | 164 | | 89801 | 51.35 | | **89822** | **3.75** |
| 89821 | 160 | | 89799 | 50.67 | | 89801 | 2.63 |
| 89812 | 153 | | 89796 | 50.00 | | 89803 | 2.58 |
| 89802 | 111 | | **89828** | **49.67** | | 89834 | 2.53 |
| 89807 | 105 | | 89821 | 49.19 | | **89841** | **2.08** |
| 89823 | 103 | | 89812 | 48.88 | | 89843 | 1.86 |
| 89828 | 100 | | **89754** | **48.41** | | **89888** | **1.84** |
| **89759** | **98** | | 89805 | 47.95 | | **89871** | **1.81** |
| 89754 | 97 | | 89813 | 47.95 | | 89813 | 1.76 |
| 89811 | 96 | | 89780 | 47.95 | | 89923 | 1.63 |
| **89822** | **96** | | 89854 | 47.80 | | **89854** | **1.59** |
| 89825 | 95 | | 89792 | 47.65 | | **89828** | **1.59** |
| 89827 | 95 | | 89823 | 47.50 | | 89862 | 1.44 |
| 89808 | 93 | | 89761 | 46.63 | | 89823 | 1.28 |
| 89756 | 91 | | 89784 | 46.63 | | 89786 | 1.25 |
| 89761 | 87 | | 89806 | 46.34 | | 89865 | 1.24 |
| 89790 | 86 | | 89797 | 46.20 | | 89897 | 1.18 |
| 89764 | 85 | | 89786 | 45.92 | | 89784 | 1.16 |
| 89789 | 84 | | 89803 | 45.51 | | 89861 | 1.07 |

Table 6.2: Top Twenty Social Capital Measures

Figure 6.1 is a social network diagram of the CoP which illustrates the in-degree measures of the social network for question 1 (communication). The larger node size represents a high number of incoming ties and the small nodes represent individuals with fewer incoming ties. The black nodes represent individuals who were selected to be members of the CoP. This diagram illustrates the centrality of the CoP members within the social network and that they possess varied in-degree measures.

The CoP consisted of eight staff members. Two months following the FMS implementation, semi-structured interviews were conducted with two members of the CoP and three FMS project leaders. Interviewees were selected based on their involvement in the FMS implementation and the desire of the researcher to gain a perspective from both the inside and the outside of the CoP.

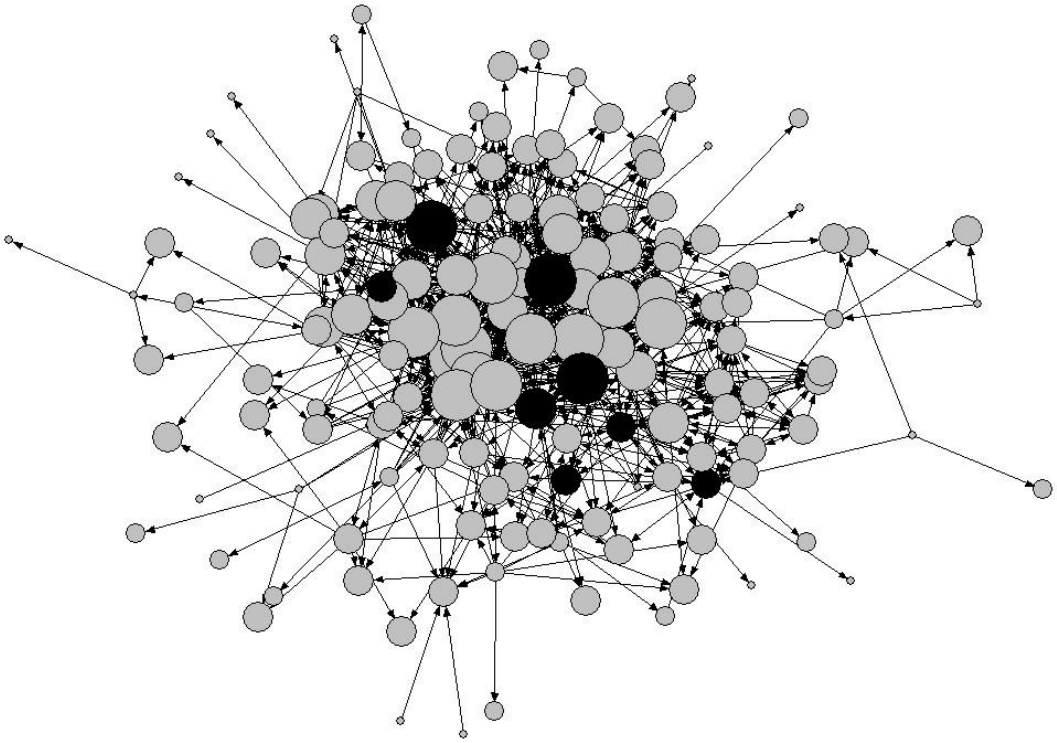

Figure 6.1: Alpha University In-degree Measures for Question 1

The purpose of the interviews was to explore proposition 2. The interviews provided follow-up information on how the university used the results of the social network analysis to inform membership of a CoP, whose role was to support the FMS implementation. The hope was not only to understand the value of the CoP in supporting technology acceptance, but also if the right individuals were selected to form the CoP.

The names of the interviewees have been changed for confidentiality purposes. Pseudonyms have been created for each interviewee. They are:

| | |
|---|---|
| Project Leaders: | Deb Johnson, John Jacobs, and Kevin Smith |
| CoP Members: | Julie Anderson and Lawrence Fisherman |

The interview questions consisted of the following. Follow-up questions were asked to gain further insight.

- What role has this CoP played in the FMS project and the implementation of the FMS?
- Were the right people selected for the CoP?

- 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?
- What could have been done differently to make the implementation even more successful?
- What do you see as the future role of the CoP?
- Do you have any other observations or feedback as to what worked well and what did not work so well as pertains to the CoP role in the FMS implementation?

The interviews were digitally recorded and then transcribed. The transcribed texts were reviewed and coded using SPSS Text Analysis software (SPSS_Inc., 2006b). A Pseudonym was created for the name of the CoP for confidentially purposes. "FMS IG" is inserted into the transcripts in place of the name of the CoP.

With five interviews, it was somewhat difficult to find trends. Each question produced a list of terms that were repeated no more than three or four times. By reviewing all the questions, however, and reflecting on the purpose of the CoP, it was possible to create a set of categories and analyze the interview texts based on those categories. Text from each question was linked to the categories. The major categories were communication, implementation efficiencies, sounding board, and training. Table 6.3 summarizes the total number of times these categories are mentioned throughout the interviews.

| | |
|---|---|
| Communication | 30 |
| Implementation efficiencies | 31 |
| Sounding board | 34 |
| Training | 36 |

Table 6.3 Interview Categories

### 6.2.1 Were the Right People Asked to Join the CoP?

One goal of the interviews was to better understand if the right people were selected to be in the CoP. This is an important question in that it directly pertains to proposition 2 and leads to a better understanding of how social capital could support a technology implementation. When asked the question, Were the right people selected for the CoP?, the interviewees had slightly different answers. Julie

Anderson, for instance was not sure if the right folks were selected and her comments could be interpreted that one individual did not contribute to supporting the FMS. She did understand the importance of social capital when she talked about membership consisting of people whom others turn to. Julie Anderson said, "*I don't. I think I could understand the reasoning behind the people that were in it. People like,* name omitted, *she was taken aback to being in the group. Because she doesn't actually, she wasn't even a* FMS *user. You know, she found it a bit strange and I suppose that was a bit odd. These were people who people turned to, you know, so I could understand it. I certainly think it was, it was beneficial to the people who were on it."*

Lawrence Fisherman shared Julie's insight that a couple of individuals were never sure why they were selected and did not support the process. He, on the other hand, expressed pride in the fact that he had been selected and recognized for the central role he holds in the organization. This could be interpreted as a sort of motivational factor causing Lawrence to work harder for the CoP. Overall, Lawrence thought the mix of individuals was good. Lawrence stated, "*I was quite pleased. Maybe I would say that. But, there were one or two people who, I think they were surprised they were on the group. But, I thought it was quite a good representation. We had, very occasional users, we had very heavy users, we had some from Finance. We had, given the numbers involved, decent representation from the academics side, as well I think. Which is often something that is perceived to be overlooked. Certainly when it comes to systems and you know, IT and what have you. So, yes, broadly, I think so. You know I think so. As I say, one or two people, I think, themselves weren't quite sure what their role was. I remember one particularly, who said, well, I won't be trying to contribute to this because my area is so narrow. But I said, yes, but when we get into that area you are the expert aren't you. That is the thing."*

Project leadership felt the right people had been selected, although there could have been more representation from specific functional areas. Overall, FMS leadership felt the individuals were functionally and organizationally varied and had access to good communication channels. Kevin Smith said, "*I believe so, I mean I had only been at the University for 3-4 weeks when the meetings started and I didn't know the people, but 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 to communicate back."* John Jacobs said, "*Yes, they were very varied. And, it was varied in the amount of use that they make in their day-to-day work off a Finance System. Some of the people who were using it came and others who were perhaps supervising individuals who use it but didn't actually use it hands on much themselves*." And Deb Johnson said, "*Um, we could possibly have done with slightly more representation from outside the central finance, central research, accounting*."

### 6.2.2 Contributions of the CoP

The bulk of the interview questions were designed to understand the contributions the CoP made to the FMS implementation. Upon review of the interview transcripts, four basic themes emerged: communication, efficiencies, sounding board, and training. The next four subsections present those themes.

Communication

All interviewees commented on the role the CoP played in communicating throughout the implementation process. They talked about communication flowing in two directions: to the implementation team and back to the user community. They also discussed the importance of communicating via Alpha University's web site. Following are selected quotes which reflect this theme:

Deb Johnson, the FMS Project Leader, described, in her interview, how the CoP was selected and the importance of communication in the FMS implementation, "… *from widely diverse parts of the university, outside the finance office who were identified as we've established in some earlier work as been particularly at the center of various networks of other people within the university, so they served a two way role of communication, really that was their biggest impact of communicating outwards from the project to the various people they were networking with but also communicating into the project the thoughts and reactions of the people outside."* Deb's reflection illustrated the recognition by project leadership of the need to communicate across the enterprise in order to successfully implement a new

technology. She reflected on the need to share information or diffuse innovation throughout the organization. She also mentioned the importance of getting feedback from users on how to best create processes that facilitate that diffusion. This is consistent with Rogers emphasis on communication processes to share information and reach a mutual understanding (Rogers, 1995).

As a project leader, Kevin reiterated Deb's observation on the importance of getting feedback from the users on how best to diffuse innovation into the organization. The users understand the environment and the language of their peers and offer valuable input into the diffusion process. Kevin Smith, when talking about the role of the CoP, stated, "*It was mainly guidance in terms of the information we needed to communicate out to the users. I mean, you know, we sort of bounced a few ideas off them. And, I mean, it was really they that was really steering the communications that we were putting out*."

Julie Anderson stated, when asked about the CoP's role in the FMS implementation, "*I think we impacted on communications a bit because they* (the project leaders) *would say, we are going to do something or we're going to do this, this week, and we* (the FMS IG) *would say, are people aware that they would be called upon to do testing or whatever? And are the line managers aware? So, I think in that way we did ease some of the implementation processes because I would think, in hindsight, communications was a key issue that people found that wasn't sufficient."* Julie's comments substantiated both Kevin's and Deb's comments concerning the value of getting feedback from users on how to best diffuse the technology. Julie stated very clearly her evaluation of the importance of her and other users inward communication to the implementation process.

The web was the only specific communication technology mentioned in the interviews. The researcher interpreted much of the other communication references to be e-mail and voice. However, the web was highlighted as an effective means of sharing information and that it could have been used even more effectively in support of a technology implementation. Lawrence Fisherman made this comment about the importance of the CoP in communicating on the web, "*And I think that the other thing is the one or two things that appeared on the web site. The translation*

*tables and although, I don't think they trumpeted them as well as they should because they were excellent. Some of the little look-ups and inquiries that got written to, just got written to menus, which the team leaders just went off and did because obviously they had been a mess and they said that would be really useful. For example, if I got a product, what's the account code, and if I have an account code, what's the product? These little look-up tables that came out and I said to, I mean one of the things I said, was that I just discovered this by accident and it's fantastic."*

Efficiencies

The second major contribution to the technology implementation that emerged from the interviews, specifically from the project leadership, were the efficiencies created by the CoP that contributed to the testing, problem solving and roll-out of the new technology. Deb, as project leader, again reflected on how the CoP supported the diffusion of innovation, by suggesting that the CoP influenced training, communication, and other implementation strategies. Deb also attributed the CoP with keeping the project on course. Deb Johnson, when asked whether the CoP contributed to a more efficient FMS implementation, responded, "*Yes, I do, because we would have probably done some things, if they hadn't been there. We would have probably done some things that would not have worked and by discussing with them first of all, and getting their suggestions and ideas about how to go about training, how to go about communication, and post-implementation, some of the problems that were arising… I mean I didn't say that, they were also been quite active in the post-implementation support. 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."*

John Jacobs, confirmed Deb's observation that the CoP kept the project on track. John elaborated on this theme by providing details as to how the CoP supported a more efficient technology implementation. John Jacobs said, "*I think it* (the FMS IG) *helped us* (the project team) *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.*

Kevin Smith added testing as another area where the CoP contributed to an efficient technology implementation. More efficient testing could be interpreted as a specific example of how the members of the CoP used their centrality, or understanding of their social network, to provide relevant feedback that produced efficiencies in the testing of the new software. Kevin Smith said, "*They* (the FMS IG) *contributed quite well. They certainly came up with, say, examples of situations that we would need test for. You know, it was quite good to get some objective test criteria. Because, as you know, when you work as a project team, you get very focused on doing things in certain ways. It is useful to stand back a little bit and they provided that."*

Sounding Board

A third theme that emerged from the interviews was the term, "sounding board". A number of interviewees reflected on how the CoP served as a sounding board for the project team to bounce ideas off of. This theme is consistent with some of the reflections on communication in that the CoP brought information to the project leadership that supported the implementation and made it more efficient. In this same vein, the project leadership brought information to the CoP to gain perspective into the most effective ways to diffuse the technology throughout the organization.

John Jacobs highlighted the function of sounding board as one of the main purposes of the CoP. He also elaborated on the importance of the two-way communication to the diffusion of innovation. John Jacobs stated, "*We used it* (the FMS IG) *primarily as a sounding board and as a means also for spreading information out to the users, as well. That was our main purpose. I mean, as the* FMS IG *grew, continued to meet right through on a weekly basis, then what was often happening, the users were feeding problems to them and they were bringing problems along to resolve. So it was a means for users of escalating resolution of difficulties that they had. Particularly once we became live."*

Kevin Smith also reflected on the sounding board theme and supported John's emphasis of it as serving as a primary role of the CoP. Kevin said, "…*they* (the FMS IG) *came along and gave us guidance as to what they thought we should be doing. So, we asked that for bits of information, but mainly it was really as a sounding board, I suppose."*

Training

Training was the last major theme that arose from the interviews. Training is another form of communication and a means that project leaders have to diffuse the new technology into the organization through both teaching how to use the new technology as well as sharing the benefits of the new system. Training may also be an important intervention, depending on the results of the UTAUT survey and individuals perceived ease of use. Several interviewees talked about how the CoP supported the FMS implementation by training end users and developing training materials. Lawrence Fisherman felt the training was very useful from a CoP member perspective and highlighted, again the importance of communication, specifically face-to-face communication, to the diffusion process. Lawrence said, "*I think the workshops, post-implementation workshops, were very useful… they enabled departments within their own setting to raise their concerns and be talking face-to-face with the team."*

Kevin Smith, as a project leader, confirmed Lawrence's observations. Kevin felt that the CoP improved the content and delivery of the training through their understanding of the FMS and functional user needs. Kevin stated, *"Also, to ask as to whether they thought things were good ideas. Should we approach training in a particular way or should we cover some aspect of the system in training? Should we put it on the website, what information is required? That was really where it was useful."*

Overall, these interviews provide insight and understanding into how a CoP, and the social capital of their members, can support the diffusion of innovation, an enterprise-wide technology implementation, within a higher education organization.

In this case, the CoP supported communication, created efficiencies, served as a sounding board, and improved training.

### 6.2.3 Diffusion of Innovation

The last section provided a broad overview of the themes that emerged from the interviews, this section looks at specific examples of the impact of the CoP on the diffusion of technology into the organization (Table 6.4). The interviewer reviewed the interview transcripts in order to gain a better understanding of the relationship between the four elements of diffusion of innovation (innovation, communication channels, time, social system), the CoP, and its members who possess a high degree of social capital.

| **Diffusion of Innovation** | |
|---|---|
| Innovation | Technology implementation<br>End user report manipulation |
| Communication Channels | Web site<br>Training<br>Face to face communication |
| Time | Implementation on time<br>Adoption by the CoP |
| Social System | Problem solving<br>Sounding board<br>Accomplish goal |

Table 6.4: Examples of Diffusion of Innovation at Alpha University (Rogers, 1995)

Innovation

The innovation aspect of this research is an enterprise-wide Finance Management System that needed to be implemented at Alpha University. John Jacobs provided a good, specific example of how the FMS was diffused into the organization. He discussed his feelings of accomplishment that users can now manipulate information and reports by themselves. This represented an accomplishment for the organization and a change for the users. John went on to credit the CoP with facilitating this change. John Jacobs said, "*What has been the most successful part of the implementation? Getting users to start to manipulate their reports for themselves. Getting them over the threshold of saying, if I change a report, I'm not going to break the system. And, I think, the* FMS IG *was helpful in the respect. With*

*focusing probably on one individual within that crew. She had been saying, I've done this, it works for me and I'll come along and show you how to do this. So that people within the group, they are starting to share their experiences and then sharing experiences out within that web of contacts that they have got*."

Communication Channels

As mentioned above, communication is another important aspect in the diffusion of innovation (Rogers, 1995). Lawrence provided a specific example of the power of the web in sharing information and documenting a potentially difficult process change. As a member of the CoP, Lawrence, understood the need to share important information through effective communication channels with the larger community in order to facilitate change and adoption of new technologies. Lawrence Fisherman said, "*I think the workshops, post-implementation workshops, were very useful. Where I think* the FMS IG *organized them and that enabled departments within their own setting to raise their concerns and be talking face-to-face with the team."*

As a project leader, Kevin described the impact the CoP had on communication channels. What Kevin did not overtly say was how the prestige of the CoP influenced others' acceptance of the communication. His comments can be interpreted to mean that project leadership valued the opinions of the CoP enough to allow them to influence and determine communication content and delivery methods. Kevin Smith said, The FMS IG "*helped us define the communication, I think was the main thing. Because they were going through the project and they were saying that they didn't know what was happening and they said – tell me what is happening – so we needed to disseminate to the user base at large so we used them in that respect. So we used the meetings in that way, to basically disseminate information. Also, to ask as to whether they thought things were good ideas. Should we approach training in a particular way or should we cover some aspect of the system in training? Should we put it on the website, what information is required? That was really where it was useful."*

Time

One aspect of Rogers' definition of time in relation to diffusion of innovation is the ability of an organization to implement a new technology so that individuals use it . The FMS met its objective and was put into use at Alpha University on schedule. Deb discussed this achievement, the adoption by the user community and the CoP's role in the success of the implementation. Deb Johnson said, "*Well, clearly it's a major achievement implementing it on time and within budget and with relatively low level of support queries afterwards. So I think if I had to identify one aspect, I would say the effort that went into involving the user community in the later stages of the implementation and the ongoing work immediately after implementation to make sure that everybody understood what they were supposed to be doing and removing or dealing with the inevitable confusion and uncertainty that people have when faced with changes of that sort. The smoothness of the implementation, of the system that, although its core to the work and jobs of lots of people both inside and outside of the Finance office. It's the sort of thing that you don't want people having to spend a lot of time worrying and putting a lot of time and energy into. Something that is supposed to make their lives easier. I'm not sure it has entirely at the moment. But, I think most people who have been using it and involved in the implementation recognize that it's going to help them."*

When asked of the role of the CoP in the success of the implementation, Deb went on to say, "*Yes, that was certainly a very big part of it. Very helpful. I mean had it just been the members of the project team or finance office people, that wouldn't have been so nearly so effective. Both because it was really a credibility issue. But people always like to hear their own sort of people talking to them and the uncertainty and worries that people have were recognized, I think, by the* FMS IG *because they would have been in the same position. So, I think it was a big help."*

Social System

Julie Anderson's comments can be directly related to Rogers' emphasis on the social system and the need for joint problem-solving to accomplish a goal. Julie actually presented the situation negatively, expressing concern that solving individuals'

problems was frustrating, wasted the time of the CoP and its leaders, and resulted in a lack of focus and value for the CoP. Julie said, "*I doubt if we had a huge impact, but I do think we had a bit of an impact particularly on the communication side. But, I mean, to be honest, we took* John Jacobs and Kevin Smith *away from their very busy schedules once per week. It was meant to be half an hour, but it usually ran to an hour. And then, I think, sometimes people in the group lost sight of why they were there. And they were trying to get issues that really should have gone via the help desk, get them resolved there. And so you would sit there for an hour and everyone is really busy and you just think, well this is not a very constructive use of their time. There was times when I felt quite frustrated sitting there listening to their persistent complaints about some incredibly petty things. Things that, you know, yes they are not great, but let's sort out the big things and then we can worry about the titles here and there and wouldn't it be nice. I hate that. I mean, yes, it would be nice, but let's get everyone sorted and get the big issues sorted and then we can move to the fine-tuning. So, I did find some of that frustrating. It was a shame, you know. I just thought, I think that most people on the FMS IG group had the bigger picture in mind but some lost the way as the system was introduced."*

This situation could be interpreted differently, however. Rogers posits the need to solve problems to accomplish a goal within community (Rogers, 1995). The other members of the CoP may have been living out this need when they brought their problems and complaints to the CoP for resolution. Problems were solved, members frustrations were aired, and potentially, the members left the meeting with a positive attitude that they shared with others.

Opinion Leaders and Change Agents

The project leader's reflections provide insight into another aspect of diffusion of innovation, individual roles. Rogers' description of opinion leaders and change agents are reflected in Deb Johnson's comments. Deb Johnson is the change agent whose goal is to influence members inside the social system, the higher education organization, to change and adopt the new technology. The CoP consisted of opinion leaders, central individuals who the organization asked to influence others in support of the implementation (Rogers, 1995). Deb highlights the credibility of the

members of the CoP and their role in the diffusion of innovation. Deb Johnson said, "*Yes, that* (the FMS IG) *was certainly a very big part of it, very helpful. I mean had it just been the members of the project team or finance office people, that wouldn't have been so nearly so effective. Both because it was really a credibility issue, but people always like to hear their own sort of people talking to them and the uncertainty and worries that people have were recognized, I think, by the* FMS IG *because they would have been in the same position. So, I think it was a big help."*

This section looked at the findings in relationship to diffusion of innovation and the CoP's role in supporting the implementation of a new technology. The interviews provided examples from both project leaders and CoP members that the CoP did support the diffusion of innovation in a variety of ways. The next section will look at how the CoP could have been improved.

### 6.2.4 What Could Be Done Differently?

This section focuses on how the CoP could have been improved to better support the FMS implementation. One area that came up several times during the interview, both as a result of a direct question and when reflecting on other areas, was the need for the CoP to define their own goals and objectives.

The CoP never got around to organizing itself and creating goals and objectives or terms of reference. Julie Anderson said, "*We tried to. I think it is intentional, that there is an intent for us to continue. The problem is that we've just been so busy, so very, very, very busy. But, we supposed, I think* 'name omitted' and Lawrence Fisherman *were supposed to be coming up with terms of reference for the group and that just hasn't happened yet."* Later in the interview Julie said, *"We should have sorted out terms of reference and really gotten ourselves going, but it was very difficult and most everyone was under so much pressure to do that, so under the circumstances, it kind of drifted I think."* Lawrence Fisherman followed up on this topic later as well and said, "*we sort of, not defined our own role, we were told what it was, if you know what I mean, but it was never terribly formal. And, I think, we could have."*

Project leadership shared the opinion for the need for terms of reference. Kevin Smith said, "*Nope, we asked them at every meeting to define their goals and objectives and they never did.*" John Jacobs said, "*I think it would have helped if they would have come up with a more specific terms of reference. It tended to drift away from what the original purpose was and sort of started to become a pressure group for getting things fixed. And, so it was good in bringing information to us, but I'm not sure how effective overall in pushing information back out."*

The development and agreement on terms of reference may have addressed many of the concerns raised by members of the CoP in that they did not understand their role or why they were asked to participate. It could have also alleviated some of the frustrations concerning lack of focus as described by Lawrence when he stated, "*Then, we got to post-live, it tended then to get into this, sort of list of somebody's problems which we spoke about earlier on. Perhaps we could make better use of the short amount of time."*

A clarification of goals and objectives as well as explaining to the CoP how the members were selected, may have resulted in a better understanding of roles, an increased motivation to meet the objectives. The invitation to participate in this elite group, could potentially increase job satisfaction leading to increased support and adoption of the FMS.

Another area of improvement is communication. Specifically, the CoP inconsistently communicated outwardly to the broader community. Lawrence did. When asked, "Did you find yourself when you came back from those meetings, disseminating information out to your colleagues?", Lawrence responded, "*Yes, and quite widely. Both my* teams *and to the wide community. What I did is that I set up, what I call a* FMS *group and an e-mail address for* my department *and it didn't happen terribly often but if things come out, where I think you ought to know this, I would fire things out to people. A lot of it was word-of-mouth. And, certainly in terms, for example, some of the code lists on the web and so on that went out, an awful lot of people have short cuts to them. Because when I said – don't forget to look there. One of the downsides of the web is that, unless something triggers you actually look at it, you just don't go there."* Julie, on the other hand, did not. When

asked, "Did you come back and share information with your colleagues?", Julie responded, "*I can't say that we did. We might have done if people asked. But, we didn't*."

Project leadership also expressed concern for communication and the need to consistently share information with the user community. John Jacobs said, "*I think we could, if we had one individual whose sole purpose was to do communications and maybe not his sole purpose, but also who had expertise because one of the things we didn't do was vary the means of delivery of any message and after awhile people just oh – they got stuff on the web site, have a look at that, so therefore we needed to do something different to use. We didn't have that expertise."*

A couple of other areas for improvement were mentioned, but only by one individual. For instance, Deb, as project leader, reflected on the need for additional representation from particular departments in order to get broader feedback and participation. Deb Johnson said, "*I can't immediately, no. We didn't have anybody in that group, I don't think, from* Department A *or* Department B *and maybe, when the networking analysis, those are two areas that exist almost in sort of self enclosed group. And maybe we didn't recognize that and we could have perhaps included somebody from those areas. But I can't think of anything that the group, not immediately, that the group themselves could have done better."*

Lawrence reflected on the advantages of the CoP if they had been given authority to prioritize and allocate resources in support of the implementation. If the CoP's role was to support the implementation and the members are central to the organization in that they are opinion leaders, then perhaps being given the authority to suggest priorities may have been valuable. Lawrence stated, "*I think one of the things we tried to do was to put a bit of pressure on the those involved centrally in the project to, perhaps, skew key resources a little. I mean, that wasn't within our remit, but, I mean, certainly as a group of users, we were concerned that there seemed to be less movement in some areas than what we would like. But other ones seemed to be perfectly fine and kind of meeting their goals and so on. And, on one or two occasions, can't there are a lot of bodies down in* location omitted*, for example, could somebody not be roped into helping in one or two areas? I didn't feel that we*

*had any kind of jurisdiction in that area. I think that might have been quite useful – even just to suggest."*

One additional suggestion by Lawrence, was the idea to spend more time together as a CoP. He reflected on the challenge of time and how the CoP could have done more if additional time had been allocated to them. Lawrence said, "*I'm not sure we spent very much time together, either. And I think time is a premium for everybody. But I did feel that although we, I think without fail, over ran, probably the time allocated was a little short. We could perhaps have gone into some things a bit deeper. But I think within the remit that we had, I think we probably did as well as any other group of people would have done."*

Table 6.5 provides a summary of what worked well and what could have been improved at Alpha University for the CoP to function more successfully. This list is useful for Alpha University as it moves through the Action Case and defines interventions to improve the next phase of the FMS implementation. The list is also useful for other organizations if they decide to nurture a CoP to support their enterprise-wide technology implementation.

| **What worked Well** | **What could be improved** |
|---|---|
| Web communication and documentation | Lack of understanding of role / Need to define goals and objectives |
| Communication to project leadership | Better communication – specifically outward to functional users |
| Sharing information and solving problems within the CoP | Use the web more effectively |
| Kept project team focused and on track | More department representation |
| Influenced training, testing, and communications | Allocate more time to work as a CoP |
| Post-implementation workshops | Authority to prioritize and allocate resources |
| Training delivery | |

Table 6.5: What Worked Well and What Could Be Improved with the CoP

### 6.2.5 Future of the CoP

The interviews also served as a means for the organization to gather the information they needed for the evaluation phase of the Action Research cycle. The last question had to do with post implementation and the future of the CoP. When asked, "What do you see as the future role of the CoP group?", the interviewees had positive ideas on how the CoP could be used to assist phase two of the FMS implementation. Julie focused on the continued need for communication and training. Julie said, "*I can see it could be beneficial to continue it just from the stand point of communications because the university is very bad on communication and I think that this sort of group focus on improving communication aspects."* Later, Julie went on to say, "*I think we could be useful in a way, I suppose, because I will be going out to my administrators helping them get used to the system, helping them set up reports, showing them how to look at them. I know they are going on training, but you know, you have to make sure you focus on what they need. So they get the training that they need, they get the help that they need and they can use the system for the purposes that they need it for."*

Both project leaders expressed the need and decision to continue to nurture the CoP. The main purpose being to provide ongoing feedback to project leaders, help set development priorities, solve problems, and communicate with the wider community. Kevin Smith said, "*Well, I think it, that their role has been defined actually, and they have already been incorporated into the support structure. And there is a defined structure for providing support and information and management of the FMS implementation. So, there's the strategic group and there is a management group, and* FMS IG *members will sit on, or a* FMS IG *member, will sit on the management group to provide the user perspective of the project. And the* FMS IG *themselves, again they have been tasked with setting out their revised terms of reference, which basically answers to a standing body for the user,s so that they will represent the users to the management group."*

John highlights the need to understand the priorities of the university and functional areas in order to identify enhancements and prioritize them. John Jacobs said, "*The* FMS IG *group is moving to, it's going to expand a little bit more and it's going to*

*become a finance users user group.* The FMS *user group within the university and they then look at enhancement requests that people have in terms of functionality enhancements more than anything else from users and decide which ones are the priority, which ones matter to users as a community and then pass that forward to the strategic management group so that we can then get on and do it."*

Deb recognizes the continued role of the CoP and the value to Alpha University of leveraging the social capital residing there when she reflects on the CoP diffusing best practices across the enterprise, serving as a information repository, and influencing future FMS development. Deb Johnson said, "*Well, I think they have quite an important role to play in being the source of comments and suggestions about how the software could be developed or techniques that they themselves are using because they are all expert users as well, promulgating best practice definitely out into the community but also continuing this role of feeding back into the project aspects that aren't working well, that need attention or areas for future development that might not be immediately be apparent, that are important to the end users. So that communication role again."*

## 6.3 Summary

This chapter presented the findings from the second proposition, "How can a Community of Practice comprised of individuals with high social capital be enrolled to support a technology implementation?" Interview data was presented and categorized in several ways. First, common themes that emerged from the interviews were outlined and backed up with interview transcripts. Second, the interview data was analyzed in terms of diffusion on innovations in order to understand how the CoP supported the diffusion of technology into the university.

Third, a number of areas that could have been improved in order to make the CoP more successful were presented as well as a table outlining what worked well and what could have been improved. This information is useful not only in improving future technology implementations at Alpha University but also for other institutions who wish to deploy this model to support their technology implementation. Lastly,

the Community of Practice was institutionalized at Alpha University and will be nurtured in the future to support phase two of the FMS implementation.

# 7. Discussion

> *"… social networks are an individuals' primary source of influence in relation to their attitudes towards new technology and a key determinant of their eventual behavior."* (Murphy and Chang, 2002: 875)

## 7.1 Introduction

This chapter will discuss the results of the data analysis in relationship to the conceptual framework and propositions for this research. It begins with a discussion of the general technology acceptance analysis to further Venkatesh et al.'s (2003) UTAUT model research. It reflects on the similarities and differences in the samples and findings of the UTAUT model analysis in three higher education organizations.

The next section discusses the findings from proposition 1, "Is social capital, as identified through SNA, a stronger predictor of Behavioral Intention than the Social Influence construct of the UTAUT model?" organized into two hypotheses. First, the use of social network analysis centrality measures to identify social capital as a predictor of behavioral intention when integrated into the UTAUT model will be discussed. Second, the use of SNA influence measures as an alternative to the Social Influence construct as a measure of the behavioral intention of important others will be explored in relationship to an individual's behavioral intention.

This is followed by an exploration of the findings from proposition 2, "How can a Community of Practice comprised of individuals with high social capital be enrolled to support a technology implementation?" Interviews with key members of Alpha University's CoP will be discussed in relationship to the use of social capital to support an enterprise wide technology implementation. This chapter concludes with a reflection on the use of mixed methods and outlines a refined conceptual framework based on the experience of conducting this research.

## 7.2 Technology Acceptance – UTAUT Model

This section looks at the results of UTAUT model analysis utilizing data from the three case universities. Data from Alpha University and Midwest University is compared to Venkatesh et al.'s original UTAUT research (Venkatesh et al., 2003). Lastly, intervention recommendations derived from the UTAUT model for each case will be shared.

This section looks at the similarities and differences of the two UTAUT cases, Alpha and Midwest Universities. The two universities were similar in a number of ways. Their demographic make-up was similar with average age in the early to mid 40's, more females than males, and workers with 7-10 years of experience. Both institutions were at the early stages of an enterprise-wide technology implementations that would require employee participation from across the institution. In other words, use of the technology was not voluntary.

The differences between the two organizations included the type of technology to be implemented, the project timeline, and the survey administration timeline. Alpha University was beginning a finance management system migration from an existing application. The social network survey was done well before the start of the implementation and the technology acceptance survey completed immediately after orientation training. The finance system was up and running within a couple of months following the orientation.

Midwest University, on the other hand, administered both the SNA and the UTAUT surveys simultaneously, immediately after an orientation on a new business intelligence reporting tool. The reporting tool would not replace an existing application, but instead add functionality and value to the organization. Also, the installation was not imminent and it would be several months before users received additional training and the application went into production. In addition, individuals in this case had just recently completed an enterprise-wide technology implementation and may have become accustomed to the changes associated with the implementation of new technologies.

In spite of these differences, the results of the UTAUT survey were fairly comparable between the two universities. Both samples resulted in behavioral intention to use the new technology as the strongest of the eight UTAUT variables with Alpha University at 1.39 and Midwest University at 2.23. The scales were based on a 7-point Likert scale where 1 was strongly agree, 4 was neutral and 7 was strongly disagree.

Performance Expectancy was also significant in both samples as either the strongest or second strongest predictor of behavioral intention with 75% of the variability in BI attributed to PE at Midwest University. The correlations at Alpha University were all very small. PE, however, was the second strongest predictor of BI with 7% of the variability in BI attributable to PE. These strong results of PE are not unusual. Performance Expectancy has been found to be the strongest predictor of behavioral intention, not only in the UTAUT model, but also in previous models such as TAM and TAM2 (Venkatesh et al., 2003, Chang et al., 2007). Therefore, the resulting significance of PE in this study is consistent with the results of the original UTAUT research for this construct.

Performance Expectancy is also one of the more important constructs and is comparable to TAM's Perceived Usefulness construct which has been shown to be critical for IT adoption (Ma and Liu, 2004). Therefore, as the end users of each organization understand the functionality, features, and usefulness to their jobs, their performance expectancy will increase and their likelihood to adopt the new technology will increase.

The Social Influence construct also resulted in the strongest or second strongest correlation to Behavioral Intention in both institutions. Social Influence represented only 8% of the variability in BI at Alpha University, but it was the strongest correlation. At Midwest University, where the correlations were much stronger than Alpha University, 50% of the variability of BI could be attributed to SI. The significance of these results is important to this research, since it is focusing on ways to improve the predictability of BI through alternative social influence constructs. This will be discussed further in the next section.

SI is moderated by gender, age, experience, and voluntariness of use. Of note to this research, is that neither gender, age, nor experience moderated social influence in either population. The only correlation to social influence in both institutions was voluntariness of use. This is consistent with the fact that in both cases, the new technology would be mandatory.

It is interesting that social influence, when inconsistent in other studies, was significant in this research when many of the other constructs were not. This could be attributed to the fact that the implementation was mandated by the organization and that the research was done at the very earliest stages of the implementation (Venkatesh et al., 2003). Therefore, the overall resulting significance of SI in this study is consistent with the results of the original UTAUT research for the SI construct.

The striking difference between the two universities is the difference in regression analysis results, PE, EE, and SI. Alpha University resulted in 11% of the variance in BI whereas at Midwest University, these three constructs accounted for 75% of the variability of BI. This could be due to the fact that Alpha University is a much larger environment with individuals spread out in the organization as evidenced by Figure 5.9 resulting in a lack of consistency in the sample. The other difference that may have affected the results is that Alpha University was implementing the technology immediately, resulting in more user stress when completing the survey. Whereas Midwest University was looking at the new technology as a possibility for the future, resulting in users giving their opinion of the software from a more impersonal perspective without worrying about the implications to their daily work.

The UTAUT Model is an established and validated model. The analysis of Alpha University and Midwest University in the UTAUT model produced significant results for behavioral intention, performance expectancy, social influence, and voluntariness of use. In addition to reflecting on the data as related to the UTAUT model, the data can also be interpreted to support practice and provide information to project leaders on how to prioritize their resources and provide effective interventions in order to improve the individual technology implementations

(Anderson et al., 2006, Bandyopadhyay and Fraccastoro, 2007, Garfield, 2005, Reunis and Santema, 2005). Based on the results of the surveys, interventions were developed for each of the three higher education organizations. A summary report was prepared and delivered to each university that included social network analysis diagrams, UTAUT survey results and recommended interventions to improve the technology implementation. A sample of the summary report provided Saints College is located in Appendix F.

At Saints College, the lowest scoring constructs were self-efficacy and anxiety. Both self-efficacy and anxiety are linked to an individual's self-confidence in their ability to use technology to do their jobs and the stress resulting from that. Neither of these categories have been proven in past research to significantly impact an individual's intent to use a new technology, so the project leader need not be too concerned. However, as he looks at ways to improve the implementation, he could take into account that there seems to be some amount of anxiety over using the technology and a lack of self-confidence that they will be successful in the use of the new technology. Therefore, he may want to intentionally celebrate and highlight individual successes to help build confidence and spend additional time meeting with the end users about the technology to help relieve anxiety.

The lowest scoring categories at Midwest University were self-efficacy and facilitating conditions. Facilitating conditions relates to an individual's belief that organizational and technical infrastructure exists to support the reporting tool. Similarly to Saints College, Midwest University displayed a lack of self-confidence by respondents that they would be successful in the use of the reporting tool. Respondents also seemed to be concerned that support and technical infrastructure may not be available for the implementation. The project leader, again, could ensure that successes and accomplishments are communicated and acknowledged as a way to build self confidence. He may also want to add additional training and review and communicate support that will be available throughout the implementation to ensure that users have the support they need and the confidence to use the new technology.

At Alpha University, 98% of the users who completed the survey predicted that they would use the new technology. Behavioral Intention was the highest scoring category, followed by social influence and voluntariness. The remaining categories averaged just to the positive side of neutral. The project leader could interpret the results to mean that individuals are taking a "wait and see" attitude as far as their opinion on the performance of the technology and how much effort it will take for them to use it. These results do not give as defining a picture as the other two institutions as none of the variables stuck out as needing attention. In fact, all of them may need attention which could indicate a well-rounded approach to the implementation that involves training, communication, internal marketing, and other best-practice interventions.

In summary, the UTAUT model is an easy to use tool that organizational leaders and project implementers can utilize to better understand the attitude of their employees in relationship to a proposed technology. The results can be used to improve the implementation by prioritizing resources and developing interventions that address the unique needs of each organization.

This section discussed the UTAUT results in the context of Venketesh et al.'s research (Venkatesh et al., 2003). It went on to provide examples of how the results could be used to support the technology implementation at each university. The next section discusses proposition 1 and its attempt to strengthen the UTAUT model by substituting social capital measures for the social influence construct.

## 7.3 Proposition 1: Social Capital as a Measure of BI

The first proposition of this research posits that the identification of social capital could strengthen the UTAUT model by replacing the social influence construct with a social capital construct. This section will focus on H1, "Social capital, as measured by SNA, will correlate with Behavioral Intention (BI/UTAUT). The higher an individual's social capital in an organization, the greater their intent to use the new technology."

Correlation analysis found no significant relationships between the social capital measures and behavioral intention in the UTAUT model in either Midwest University nor Alpha University. The regression results indicated that 22% of the variance in behavioral intention was accounted for by the social capital constructs for Alpha University and 6% for Midwest University. When including Performance Expectancy and Effort Expectancy with the social capital constructs, no improvement was experienced for Midwest University (75%). However, improvement was experienced for Alpha University. PE, EE, and Social Capital measures accounted for 24% of the variability of BI, up from 11% using SI. This analysis reflects the strength of the relationship of Performance Expectancy and relative unimportance of all other variables at Midwest University. The improvement at Alpha University reflects the relative unimportance of all independent variables, including Performance Expectancy. The social capital measures were an improvement, but not a statistically significant one.

When combining three centrality measures, in-degree, betweenness, and closeness into one social capital measure, an improved $R^2$ at Alpha University resulted. This social capital measure indicated a 12% variance in BI, up from the original 3%. This improvement in $R^2$ is exciting in that a combined social capital construct resulted in an improvement of predictability of BI over the original SI construct at Alpha University. This result indicates that additional research in the use of centrality measures as a predictor of BI is warranted.

Another interesting finding is that the regression results were comparable in that the social capital and social influence constructs produced the same result for Midwest University, a sample with a 90% response rate (38 out of 42). With this sample, we can also place validity in the social capital measures and even though the total sample is small for the UTAUT model, we can still reflect positively that the social measures may be a valid line for future research with larger sample sizes.

In addition to the three centrality measures, this research had hoped to take a look at structural holes, strong and weak ties, and their relationship to technology acceptance. Since no significant relationships were found, this research cannot

comment on the influence of strong versus weak ties on behavioral intention to use a new technology.

The overall absence, however, of significance in many relationships in both institutions may be the result of small sample sizes. The Alpha University sample size was 57 for the social capital measures and the Midwest University was 38. Both samples were too small to reliably test for influence on behavioral intention.

The absence of significant relationships is an interesting finding in that it could indicate that opinion leaders, individuals with high social capital, do not take a predictable stand on a new technology, either positive or negative. There currently does not exist a theory that correlates social capital with behavioral intention. The findings of this research indicate that a new theory that posits no correlation between intent to use a new technology and an individual's social capital would be a valid area of future research.

This section discussed the findings of H1. Important outcomes of H1 are that the improvement of predictability of BI at Alpha University and the idea that the lack of relationships could indicate no correlation between BI and social capital justifies the appropriateness for additional research. The next section focuses on an alternative modification of the UTAUT model, replacing the SI construct with a social influence measure as posited in H2.

## 7.4 Proposition 1: SNA Influence as a Predictor of BI

This section discusses the findings of H2, "The Behavioral Intention (BI/UTAUT) of important others, others who are close to an individual in his social network, will influence his Behavioral Intention to use a new technology. The higher the BI scores of those close to an individual, the higher that individual's BI." H2 resulted in one significant finding. The Friedkin measure at Alpha University produced a moderate correlation of -.510 and an $R^2$ of 26% of the variability in predicting behavioral intention. This is compared with 3% when using the original SI construct. No significant relationships were found in the Midwest University case.

At Alpha University, neither the Taylor nor Edge Betweenness SNA influence measures produced significant correlations.

It is interesting that it is the Friedkin measure that produced the significant finding at Alpha University. Friedkin combines structural cohesion, similarity and centrality in its measurement that affect two key aspects of social influence, interpersonal visibility and salience (Friedkin, 1993). Interpersonal visibility is the fact that an individual knows what others' opinions are and salience is the value that an individual puts on those opinions. Structural cohesion looks at the cohesiveness of groups because members of cohesive groups tend to be aware of each other's opinions. Similarity has to do with the positions individuals hold in the organization, either hierarchically or socially. For instance, managers who occupy similar places in the organization or central people in the social network. Friedkin (1993) posits that because an individual's initial opinion is influenced by their situation, the more similar two actors' structural position, the more similar their initial opinion. Lastly, centrality refers to an individual's position in a communication network, as has been described in this paper.

Friedkin (1993) asserts that an actor is more influenced by those who are centrally located, or have more social capital, than those who are peripheral in the organization. The Friedkin measure is very applicable to this research in that its components and definition so closely mirror what the researcher was looking for in H2. The Friedkin measure ties together social capital by looking at the organization from very relevant perspectives: structural cohesion, similarity and centrality. Further exploration of the integration of the Friedkin measure into the UTAUT model would be warranted based on the positive finding at Alpha University.

Friedkin also offers an insight as to why so few significant relationships were found in both the social capital, H1, and the SNA influence, H2, constructs. The timing of both surveys, at Alpha University and the Midwest University, were immediately after an individual's initial exposure to the new technology. The participants did not have time, perhaps, to network and determine the opinions and attitudes of others who were important to them. They also did not have enough time with their peer

group for Friedkin's interpersonal visibility and salience to have an effect on the results (Friedkin, 1993, Chang et al., 2007).

Another potential explanation for the lack of significant relationships is supported by Burkhardt and Brass when looking at the effects of technology change on organizational structure and power (Burkhardt and Brass, 1990). They posit that central figures may not be the early adopters, but may be the first of late adopters, learning from early adopters. Individuals possessing social capital and centrality in their social network, understand their network and use it to adapt to change and meet the expectations of the organization. Their study found that early adopters were not necessarily central and powerful in their organization, but they did reduce the uncertainty for others, allowing them to gain social capital (Burkhardt and Brass, 1990). Again, the timing of the survey, was such that central figures did not have a chance to learn from the early adopters and therefore, were not as strong of an influence within the organization.

This section explored the significant finding involving the Friedkin measure as the foundation for the SNA influence construct. Friedkin's work offers support for the integration of social capital into the UTAUT model in predicting an individual's behavioral intention to use a new technology. It also offers insight into the lack of significant findings in proposition 1, both H1 and H2, while supporting the need for further research. The next section will discuss the findings from proposition 2.

## 7.5 Proposition 2: Social Capital to Support a Technology Implementation

This section discusses the findings of proposition 2, "How can a Community of Practice comprised of individuals with high social capital be enrolled to support a technology implementation?" Proposition 2 is supported for this action case (Hamre and Vidgen, 2008). This case study provides insight into how one organization successfully utilized social network analysis to support a technology implementation, and more generally, how an organization's social capital could be leveraged to form a CoP to support the diffusion of a technological innovation.

As evidenced by the interviews, the social capital measures seemed to identify the right people to participate in the CoP. The CoP added value to the technology implementation process by facilitating communication between users and the project team, helping the implementation be more efficient, serving as a sounding board for the project leadership, and supporting the training of end users. Alpha University strategically utilized individuals with social capital to share information necessary for the implementation of their new technology. The participants in the CoP possessed a high level of social capital and facilitated social contagion, or the spread of new information and ideas to support the change process (Burt, 1987, Borgatti and Foster, 2003).

Second, Alpha University, in strategically utilizing those with social capital, facilitated the difficult decisions and interactions required in a new technology implementation by addressing the concept of embeddedness. By building a team of people with social capital, the University created relationships and facilitated a comfort-level with the most socially powerful people in their organization. These individuals, now supporting and on-board with the implementation, were able to move forward with decisions and initiatives more productively than if they were not "embedded" in the implementation. Their embeddedness may have also positively influenced others' opinions of the implementation leading to their intent to use the new technology.

The CoP also experienced some challenges. It could have been even more successful, for instance, if it had developed a stronger sense of role identity and had been facilitated by a strong leader (Wenger et al., 2002). The CoP did not develop formal goals and objectives. A number of issues could be attributed to the lack of an agreed upon direction and purpose. One issue mentioned by several interviewees was that the group tended to drift. As mentioned in the Post Implementation Review, attention from senior management could have nurtured the CoP and helped it manage the change process and bring more value to the implementation. Instead, the CoP turned into a pressure group for getting things fixed. The meetings got bogged down with individuals' 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. As also found in the project's Post Implementation Review, the project could have benefitted from better day-to-day communication through communication channels such as a web site or through the CoP.

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 more leadership support and a stronger sense of group identity.

Although, the CoP could have added more value to the technology implementation if it had defined goals and objectives and a stronger sense of role identity, the value it provided the organization outweighed the tendency of the CoP to lose focus and not communicate, perhaps as effectively, as it could have. The CoP has been retained and institutionalized as the liaison group between the finance user population and the finance systems steering group. The ongoing CoP is responsible for support of phase two of the FMS implementation and their role is to identify and prioritize suggestions for change to the steering group and to communicate developments to the user community.

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 their formal organization chart. This case study provides one example of how SNA can be used to gain a better understanding of a social network and how individuals with high social capital can be identified and employed to support a technology implementation.

## 7.6 Reflections

### 7.6.1 Mixed Methods

As discussed in Chapter four, Research Methods and Design, proposition 1 was analyzed from a positivist perspective. Survey data was analyzed empirically and expressed quantitatively in order to gain an understanding of the relationship between social capital and technology acceptance. Proposition 2, on the other hand, was looked at from an interpretive epistemology. An Action Research Case was deployed in proposition 2 in order to better understand a specific social situation (a Community of Practice comprised of individuals with a high degree of social capital in the context of Alpha University) and the affect of the CoP in support of a FMS technology implementation.

The researcher, understanding the issue of commensurability and the dilemma of approaching one piece of research from two epistemological viewpoints, took an overall interpretive approach. In proposition 1, the researcher prepared the data for SPSS regression analysis based on the pre-existing relationships of the UTAUT model. The data was analyzed using standard statistical tools as defined by the model and previous research. The results were reviewed and discussed as to their potential for universal applicability. However, the researcher also interpreted this quantitative data as another means to inform the overall conceptual framework and suggested unique interventions for each university.

For proposition 2, the researcher prepared interview questions with the intent to better understand the CoP's role in support of the technology implementation at Alpha University. Instead of comparing data results with universal benchmarks, the researcher listened to interviews and reviewed reports in order to interpret a unique social context. The interview transcripts were reviewed and key themes were drawn out of the content. The information was analyzed from Alpha University's perspective and conclusions were drawn that were applied to Alpha University and may be applied to other social contexts.

This hybrid approach was necessary for this researcher in that it provided a comprehensive methodology to better understand the prediction of technology adoption (proposition 1), understanding of how to support a new technology (proposition 2) and ways to change structure to improve the support of a new technology (proposition 2). The implications of hybrid research, however, remain controversial in the academic community. As discussed above, this researcher addresses the issue of commensurability by taking an overall interpretivist perspective. The technology acceptance data, although analyzed objectively, was used to inform and subjectively understand the conceptual framework at the expense of making a significant contribution to overall technology acceptance theory.

### 7.6.2 Conceptual Framework

From an IS practice perspective, there is no conflict between positivist and interpretive approaches. To better understand the complex, dynamic organization in which a technology innovation is implemented, an IS practitioner needs to employ a multi-method approach in order to predict usage, understand social structures, and influence change.

Based on the hybrid approach and the findings of this research, the conceptual framework, or research model, could be strengthened and used in IS practice. Due to time constraints of doctoral research, each case was surveyed once at the very beginning of the technology implementation. If time constraints were eliminated, this research would benefit from a longitudinal study that begins pre-implementation and provides ongoing interventions through implementation of the technology and into post-implementation. The modified conceptual framework (Figure 7.1) is based on a foundation of social capital and brings together technology acceptance and a social structure (CoP) to communicate innovation in order to improve the success of technology implementations.

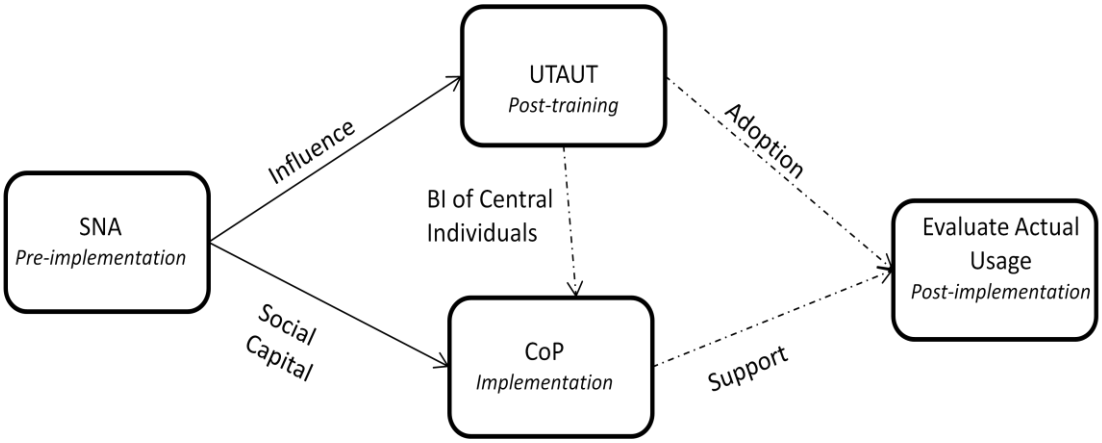


Figure 7.1: Modified Conceptual Framework

At the pre-implementation phase, the SNA analysis could be conducted in order to identify individuals with social capital. These individuals could then inform the membership to the CoP with the objective of supporting the diffusion of the new technology in the organization through communication, problem solving, and influencing others. This early measure would allow the CoP to start its work pre-implementation, bringing members on board at the beginning, which could lead to more buy-in and perhaps, a stronger intention to adopt the new technology.

The UTAUT survey would be conducted, consistent with this research, immediately upon completion of training on the new technology. This timing provides project leadership with an idea of their users' intent to use the new technology while providing them the opportunity to deploy appropriate interventions that may increase individuals' BI. Also, since the CoP has been working pre-implementation, the concern that users would not be aware of opinions of those key opinion leaders in the organization would be lessened. The CoP would have had the opportunity to share their support and excitement concerning the new technology and therefore, been a positive social influence that would be reflected in the SI construct of the UTAUT model.

The behavioral intention of CoP members could also be reviewed by project leadership as a means of assessing whether or not the key opinion leaders are on board and supporting the new technology. Project leadership could provide interventions at this point if these individuals with high social capital have low

measures in any of the constructs or do not intend to use the new technology. This review and analysis could be a key component of the research model in that the CoP has an influential role in ensuring the success of the implementation. If the membership does not intend to use the technology, the implementation may fail.

A longitudinal study would be necessary to determine actual adoption rates and the level of support the CoP provided to the implementation. A post-implementation review could be conducted consisting of both interviews and satisfaction surveys that would reflect adoption from the users' perspective. This review would give project leadership an understanding of how the CoP supported the technology implementation, similar to the analysis done for proposition 2 in this research. In addition, a review of the new software application's logs would measure actual usage. Comparing usage logs to the BI results from the UTAUT surveys would further the technology acceptance research and provide insights into how to better predict an individual's intent to use a new technology. Lastly, an SNA survey could be conducted to see if and how the organization's social network changed over the time the new technology was implemented.

Figure 7.1 illustrates this new research model including the timing of each component. The modified research model would provide an even more comprehensive understanding of how social capital can support a technology implementation in higher education organizations. It could easily be used by researchers or project leaders to support and hopefully, improve technology implementations.

## 7.7 Summary

The overall purpose of this research is to provide tools for higher education organizations to improve acceptance when implementing new information technologies. The UTAUT model proved to be a simple to use tool that organizations can easily implement as one way to better understand the attitude of their employees in relationship to a proposed technology. The results can be used to

improve the implementation process by developing appropriate interventions that address the unique needs of their organization.

Using social capital measures as a means to strengthen the social influence construct of the UTAUT model proved more challenging with the data obtained in this research. The small sample size of all institutions and the low response rate for the social network survey for Alpha University made statistical analysis difficult. One interesting finding was that the regression results were comparable in that the social capital and social influence constructs produced the same result for Midwest University and that there was an improvement in predictability at Alpha University. These findings provide hope that future research may produce more significant results.

Also, the Friedkin influence measure is very interesting and could benefit from additional research as the behavioral intention of important others to an individual's intent to use a new technology. The research also found that it may be beneficial to redo the survey two to three months into the implementation in order to gain a better measure of social capital influence on behavioral intention to adopt a new technology.

The action research case study provided one example of how social network analysis can be used to gain a better understanding of an organization's informal social network and how individuals with high social capital can be identified and leveraged through the creation of a Community of Practice to support an enterprise-wide technology implementation. Proposition 2 was easily supported with evidence from the interviews and the fact that the CoP has been institutionalized and will be used to support phase two of Alpha University's FMS implementation.

The chapter concluded with a reflection on the use of mixed methods in this research as well as a modified conceptual framework that further informs how an organization could use the social capital residing in their informal social network to improve an enterprise-wide technology implementation.

# 8. Conclusion

## 8.1 Introduction

This chapter summarizes the implications to both theory and practice on the use of social capital to support technology implementations by strengthening the UTAUT model to predict an individual's intent to use a new technology as well as informing membership to a Community of Practice whose role is to support an enterprise-wide technology implementation. It will go on to summarize the limitations of the research, as no studies are perfect and no research occurs in ideal conditions.

Thirdly, the chapter will suggest areas of future research based on the findings of this study that would exploit the use of social capital in supporting technology implementations. As a final requirement for this dissertation, the chapter will close with a reflection by the researcher on her personal journey over the course of the last four and one-half years in pursuit of a Doctorate in Business Administration in Higher Education Management at the University of Bath.

## 8.2 Implications for Theory

This section reflects on how the findings from both proposition 1 and proposition 2 contributed to theory. This research was new and innovative in that there has been very little work done integrating social network analysis and social capital with technology acceptance. The modification of the UTAUT model in proposition 1, in an attempt to strengthen the social influence construct, added to technology acceptance theory in a number of ways. First, the application of the UTAUT model to three higher education institution cases made up of professionals, not students, added depth to technology acceptance research. Most technology acceptance research has been done on students in classroom settings and the use of the tool in real-life, professional settings is valuable. In addition, the research was conducted at three institutions in two countries, implementing three different types of enterprise-wide applications. This variety of case organizations also adds breadth and depth to UTAUT research.

The findings from hypothesis 1, replacing the UTAUT SI construct with common SNA centrality measures also adds to technology acceptance theory. First, the finding of no significant relationships between centrality measures and an individual's intent to adopt a new technology, positively or negatively, is exciting. This finding can be interpreted to mean that individuals with high social capital are not predisposed to support or not support a new technology and can be influenced by the leaders in the organization. Second, the improved regression analysis for Alpha University when using performance expectancy, effort expectancy and social capital to predict behavioral intention is also promising. This finding legitimizes the use of social capital measures as a construct in the UTAUT model and justifies the need to future research.

The findings from hypothesis 2 are also interesting. When using the Friedkin measure to define social influence and replacing the SI construct of the UTAUT model with this new social influence measure, a moderate correlation between social influence and behavioral intention was discovered at Alpha University. Again, this finding legitimizes the use of social capital measures in technology acceptance research and warrants the further exploration of how to best integrate the Friedkin measure, or other social influence measures, into the UTAUT model with the goal of better predicting individuals intent to use a new technology and ultimately, improving the success of a technology implementation.

Although minimal correlations and relationships were found in this research between social capital and behavioral intention, the findings are still useful. The idea of integrating technology acceptance and social capital has not received much attention in the literature in the past. The foundational theories upon which this research is built are sound. Therefore, this research provides an innovative approach to future research in technology acceptance models.

Second, proposition 2 , the action research case study, contributes to IS research by proposing a new approach to information technology implementations based on the identification of individuals with social capital. No literature was found that used

social network analysis to identify social capital residing in organizations and then using that information to inform membership in a Community of Practice.

This action case also adds to Diffusion of Innovations theory. The findings are exciting in that in this case, the CoP contributed to all the elements needed to diffuse innovation, a finance management system, into a higher education organization. Technology acceptance requires a social channel to communicate the innovation and the CoP may be just that structure. A review of the interviews illustrate how the CoP added to each element of Diffusion of Innovation theory and leveraged the prestige of its members to successfully implement a new technology on time and within budget. This case adds credibility to the use of social capital to support the diffusion of a new technology into an organization. Future research in other contexts is warranted.

## 8.3 Implications for Practice

This research provides an innovative approach to how organizations can support their technology implementations through the identification and leveraging of social capital. This novel approach can easily be put into practice as evidenced by the Alpha University case. The revised conceptual framework outlines the timing and the research methods outline the process for each component of the model. An organization can easily start by identifying individuals with social capital during the pre-implementation phase of a new enterprise-wide technology. As Alpha University did, project leaders can then invite selected members to join a CoP whose role is to support the implementation through communication, problem solving and influencing others to adopt the new technology. It is the leaders role to nurture, support, remove roadblocks and provide resources to the CoP during the implementation phase.

During or shortly after training, the organization can administer the UTAUT survey to gain a better understanding of individuals' intent to use the new technology. As evidenced by all three cases, it is easy to integrate this type of survey into practice, gather the results, and perform basic statistical analysis. Results can then be

reviewed and appropriate interventions determined to meet the unique concerns of that implementation. The interventions described in Chapter seven are examples of how to address low scores in self-efficacy, anxiety, and facilitating conditions. Also, the BI of the CoP members can be reviewed to better understand whether or not the key opinion leaders are in full support of the new technology. If the members are in full support, the CoP could continue to move forward without intervention. If the members exhibit a low-level of support, immediate intervention would be necessary in that these are the key opinion leaders of the organization and could be detrimental to the successful diffusion of the technology. It would be important for project leaders to immediately address the concerns and worries of the CoP in order to move forward successfully with the implementation.

After implementation, the organization can perform a post-implementation review using surveys and/or interviews to gain an understanding of user satisfaction with the new technology. Leaders can also review system usage logs to measure actual usage. Interventions can then be identified based on analysis of this assessment. The social network analysis survey could also be conducted post-implementation. The SNA results would provide the organization with a view of how their informal social network changed during the course of the implementation and identify individuals who now have a high level of social capital.

Lastly, if the CoP was found valuable in supporting the implementation, this group may be institutionalized in order to continue to support the organization during phase two of the enterprise-wide technology implementation. Additional members may be asked to join based on the technology acceptance and social capital analysis results.

IS Practitioners from both large and small higher education organizations can utilize this conceptual framework. The inclusion of Saints College as one of the cases provides evidence that the UTAUT model can be delivered and interpreted for a very small organization and using one work group. The results provide insights into how leadership can intervene and potentially, improve the success of a small, mission-critical, technology implementation.

Larger organizations, like Alpha University, can also utilize this model. This case illustrated how the conceptual framework can be used across an organization to support an enterprise-wide technology implementation. Alpha University looked at the informal social network that existed across physical and functional boundaries within their organization. The same types of interpretations and interventions can be deployed across departments depending on the results of the UTAUT analysis.

Also, an organization who is gauging support for a new, strategic technology can use this conceptual framework. Midwest University was still in the decision making process when they implemented the UTAUT survey. The findings provided valuable information as to the support and services project leadership would need to offer to ensure a successful implementation. The findings could help them define priorities for the resources needed to train, communicate, motivate, or influence their organization.

This research provides valuable and exciting insight into how an organization can successfully utilize the social capital residing in their informal social network to support a technology implementation. The findings illustrate the potential for improving a technology implementation and the conceptual framework provides a road map on how to put the research model into practice.

This research contributes to higher education literature in that it was conducted in three higher education organizations, the research methods and propositions were based on theory, and the findings were applied to practice. The findings from both proposition one and two support the validity of additional research and the potential that the conceptual framework, as outlined in Figure 7.1, could indeed improve technology implementations in higher education organizations. This improvement could improve that HEO's position in the marketplace as well as save money and potentially, improve productivity. In an ever increasing competitive marketplace, this type of research is extremely valuable to the higher education community.

The research is also applicable outside of higher education. As evident in the literature, exploring the use of social capital to support technology implementations can be applied in a variety of industries such as nuclear medicine, manufacturing,

engineering, or any other organization implementing a strategic, enterprise-wide information system (Newell et al., 2004, Davidson and Heslinga, 2007, Hislop et al., 2000, Hislop, 2003). The conceptual model of gaining an understanding of the organization's social capital and then leveraging it when measuring individuals intent to use the technology and when informing membership to a CoP to support the implementation is just as applicable to a health care facility or a manufacturing plant as it is to a higher education organization.

## 8.4 Limitations

As in all research, there were limitations to this study. This section outlines the limitations associated with this research, organized into three categories as represented in the conceptual framework: social capital, technology acceptance, and CoP. These three categories represent the three different research methods used in this research: social network analysis, statistical analysis, and interview.

### 8.4.1 Social Capital

Social network analysis was used to measure social capital, the foundation for the conceptual framework of this research. Surveys were used to gather the social network data for each case. Several limitations associated with the effective measurement of social capital using SNA, as well as limitations specific to this research, are identified in this section. First, when completing a social network survey, people tend to forget important relationships or misreport interactions (Cross and Parker, 2004). The questionnaires used in this research listed all the names in the case, which was designed to reduce the impact of this limitation.

Second, the researcher is not an expert in SNA, which limits her ability to effectively select a population, deliver a survey, and interpret the results. Using a bounded sample and established questions helped minimize this limitation. The researcher also worked extensively with more experienced researchers, to reduce the impact of this limitation. Third, the small sample sizes of all three cases had the potential to provide inaccurate results (Stork and Richards, 1992). This research

used the social network measures to inform the process and took the statistical limitations into account when analyzing the data.

Fourth, 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. Care was taken to keep the identity of the individuals and institutions confidential throughout this research.

Fifth, the response rate of the social network survey at Alpha University was a near miss to the cut off acceptable rate. This research was based on the premise that in order to understand behavioral intention, it was necessary to understand the network ties of each organization's informal social network (Robins et al., 2004). If a network tie is missing, the ability to accurately describe the network context of those individuals whose ties are missing is reduced and significant information on the network context of many other actors is missing as well. Centrality measures were used that have been shown to be more accurate with low response rates, however, this limitation could have affected the results.

Lastly, the Alpha University social network survey was completed almost a year before the technology acceptance instrument. This time lag resulted in a number of people leaving the organization. Also, the social network could have changed in the time between the two surveys, leaving room for error or inaccurate results. However, in the revised conceptual framework, it is important for the organization to understand their informal social network, pre-implementation, in order to identify members for a CoP. Therefore, the organization should be aware of this limitation, but may chose to time the surveys in a similar manner as the Alpha University case.

### 8.4.2 Technology Acceptance

The UTAUT model was used to predict an individual's intent to use a new technology. A survey was used to gather the data. Several limitations exist in the

use of surveys and the UTAUT model. First, the data was reported by individuals. An assumption is that respondents will provide accurate information about their activities (Domholdt, 2005). Self-reported adoption rates, as opposed to objectively measured usage, is a controversial issue in IS research and could account for variance in results due to the halo effect or Hawthorne effect (Davis et al., 1989, Riemenschneider et al., 2003, Venkatesh and Davis, 2000).

Second, there was a small sample size which limited statistical analysis of the UTAUT instrument and reduced the power of significance tests (Venkatesh and Davis, 2000, Riemenschneider et al., 2003). More complex statistical methods, such as factor analysis and structural equation modeling, could not be used which limited the ability to compare the results from this study to that of Venkatesh et al.'s (2003) original UTAUT research.

A potential issue with the questionnaire was the implication of asking for the individual's name and demographic information on the UTAUT aspect of the research. Individuals must be identified in order to successfully complete the social network analysis. The concern involved the potential implications of identifying individuals on the UTAUT research in that people may not answer accurately and truthfully. A review of UTAUT research found that several researchers identified respondents by name or login ID in order to track system utilization (Venkatesh et al., 2003, Venkatesh and Davis, 2000, Bailey and Pearson, 1983, Riemenschneider et al., 2003). Therefore, the survey asked respondents to identify themselves.

### 8.4.3 Communities of Practice

A CoP was used at Alpha University to support their FMS implementation. Interviews were used to gather data to better understand the relationship between the use of social capital to inform the membership of the CoP and the CoP's support of the technology implementation. Limitations exist in both the use of interviews and in this action case. First, interviews in and of themselves have limitations. The interviewee may not remember events accurately, may be dishonest, or may say things for personal gain or to be socially acceptable (Punch, 1998). In addition, the interviewer may have personal biases or interpret the responses incorrectly due to

language or cultural issues (Punch, 1998). This research attempted to address these standard limitations by looking for trends or themes in the interview transcripts and drawing conclusions from items that were mentioned in more than one interview.

Second, it is not easy to identify the cause and effect terms of the usefulness of the CoP. Nor is it easy to determine the influence of social capital of its members. The interview questions may not have solicited the desired information, the answers may not be interpreted accurately, and not everyone could be interviewed (Punch, 1998). Due to time and location constraints, the researcher was not able to interview everyone on the CoP nor the entire project leadership team. Also, the interviewer was not able to interview users who were not a part of the CoP to gain an outsiders perspective. The researcher did, however, review additional surveys and the post-implementation review report in order to inform the analysis process.

## 8.5 Future Research

The use of social capital to support enterprise-wide technology implementations is an exciting research area and is ripe for future study. The interesting findings from this dissertation gives credibility to the need for further research. Studies with larger samples would provide more accurate statistical analysis and the ability to study the relationship between social capital and technology acceptance in more depth.

Longitudinal research would provide a better window into causal relationships as well as the impact of interventions on behavioral intention. It would also provide better information into the relationship between intent to use and actual usage. It would also be interesting to compare the results with a survey that was administered a few months after initial training, allowing time for social influence to take effect. This would have given central individuals the opportunity to learn from the early adopters, form an opinion and influence those close to them. It would have given others in the organization a chance to seek the opinions of those who are important to them and in turn, form their own opinions.

This researcher would like to work with more experienced social network analysts to find alternative ways to measure social capital influence that could essentially improve the social influence construct of the UTAUT model leading to a better prediction of behavioral intention and ultimately, improved use of the new technology.

Further research and more cases are needed to explore (a) the usefulness of CoP in IS implementation, (b) the usefulness of SNA in identifying appropriate members of CoP, and (c) the most effective social network measures to identify individuals with social capital. More intense action research could be conducted with CoP's consisting of individuals having a high degree of social capital to better understand the long term impact of this type of group on the implementation and ongoing integration of a new technology into the organization.

## 8.6 Summary

This research illustrates the complexity of diffusion of innovations in organizations. This dissertation began with a discussion of the importance of the use of technology applications to the success of higher education. The low success rates quoted in the introduction led to the need to find ways to improve the diffusion of technology innovations into higher education organizations. The use of individual social capital, or those with power and prestige, in informal social networks was posited to support both the prediction of technology usage through the UTAUT technology acceptance model, and the support of the implementation, through the use of a Community of Practice as the social channel to diffuse technological innovation.

This research explored new and innovative ground in Information Systems research through a multi-method approach using social capital to support technology implementations. The UTAUT model proved to be an easy-to-use tool that organizations can implement as one way to better understand the attitudes of their employees in relationship to a proposed technology. The results can be used to improve the implementation process by developing appropriate interventions that address the unique needs of their organization.

Despite the fact that this research found only two statistical relationships between social capital and an individual's behavioral intention to use a new technology, proposition 1 introduced new thinking into the world of information systems research. This study provides a foundation upon which other researchers can explore the relationship between social capital and technology acceptance.

The action case provided one example of how social network analysis can be used to gain a better understanding of an organization's informal social network and how individuals with high social capital can be identified and employed to support an enterprise-wide technology implementation. The case also added to Diffusion of Innovation research in illustrating how a CoP can be used to successfully diffuse technology throughout a higher education organization.

In addition to outlining implications for theory and practice, this chapter outlined the limitations of this research. It concluded with ideas for future research. In conclusion, this research breaks new ground in IS research that has the potential to aid Information Technology leaders in efficiently and successfully implementing new technologies in their organizations.

## 8.7 Reflections on My Intellectual and Professional Journey

One of the criteria of this thesis is to reflect critically on the impact of the Doctorate in Higher Education Management program at the International Center for Higher Education Management at the University of Bath on the student's professional and intellectual journey. This section will be written in the first person to better represent this reflection.

I have been an information technology professional for over seventeen years and have been a manager and leader in a higher education organization for the past fourteen years. I am currently the Chief Information Officer at The College of St. Scholastica in Duluth, Minnesota. The Doctorate of Business Administration in Higher Education Management provided the opportunity for me to grow as a

scholar, an IT professional, and a leader in a higher education organization. The past four years have given me the chance to learn from leading academics, professionals, and classmates on all aspects of higher education. The assignments and dissertation have caused me to stretch beyond my comfort zone both academically and professionally. This section will summarize this learning and growth.

This program has allowed me, for the first time in my career, to do in-depth research. I have had the opportunity to learn and apply social science research methodologies to both information technology and managerial studies. I have explored topics ranging from change management to knowledge management to business intelligence to social network analysis and technology acceptance. Historically, my research was limited to professional journals and trade magazines. I have expanded my reading to include academic journals and social science listservs. My thinking and decision making processes have expanded beyond information technology to include managerial, higher education, and social science concepts. I also hope to have added to the higher education knowledge space through the work of this dissertation and its resulting academic papers.

My life as a professional has also changed. I have added theoretical and global thinking to my day to day responsibilities as an IT manager. Through exposure to world-class lecturers, the experiences of my classmates, and academic research, I think through problems and decisions differently and more strategically. I may go to the literature and find an appropriate survey to assess the situation or may try to apply a theory to the problem. I also am extremely interested in doing more research to put into practice theories on technology acceptance in order to help higher education organizations utilize technology to be more competitive by improving their productivity and providing better service to their customers.

Lastly, I have grown as an overall leader in my higher education organization. I have gained a good understanding of higher education in a global context. I have researched and put into practice strategic planning, change management, and disaster response methodologies. I have gained confidence in my ability to participate at the executive level as both a professional and academic. This growth

not only benefits myself as a professional, but also my institution. I am able to contribute a more global, strategic perspective to help make better decisions and move our institution forward competitively and successfully.

In summary, this program has expanded my thinking, improved my strategic planning and decision making skills, given me experience as a researcher, given me a glimpse of life as an academic, and hopefully, added to the body of knowledge in the higher education knowledge space.

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## Appendix A Pilot Survey


### Wausau Benefits Claim Form Survey

**Please provide the following information about yourself:**

Name: _____

Age: _____

Gender: _____ Male _____ Female

Position title: _____

Department/School (location):_____

Tenure at institution in years: _____ years

Have you heard of the Wausau Benefits Web-based Claim Form?
_____ Yes _____ No

If the answer is No, you do not need to complete this survey.

Have you only heard of Wausau Benefits Web-based Claim Form by word of mouth?
_____ Yes _____ No

Have you attended the Wausau Benefits Web-based Claim Form briefing seminar?
_____ Yes _____ No

If so, when:_____

Have you attended Wausau Benefits Web-based Claim Form training?
_____ Yes _____ No

If so, when:_____

## Technology Acceptance.

Below are 26 questions on your use of the Wausau Benefits Web-based claim form. To the right of each question is the response scale to use in answering the questions. Please indicate the closest answer by placing a tick in the appropriate column from 1 to 7. Tick "not applicable" if appropriate.

| **For each of the statements below, please indicate the extent of your agreement or disagreement by placing a tick in the appropriate column** | **1 Strongly Agree** | **2 Agree** | **3 Somewhat Agree** | **4 Neither Agree nor Disagree** | **5 Somewhat Disagree** | **6 Disagree** | **7 Strongly Disagree** | **Not Applicable** |
|---|---|---|---|---|---|---|---|---|
| 1. I predict I will use the Wausau Benefits Web-based Claim Form | | | | | | | | |
| 2. People who are important to me think I should use the Wausau Benefits Web-based Claim Form | | | | | | | | |
| 3. The Wausau Benefits Web-based Claim Form is not compatible with other systems I use | | | | | | | | |
| 4. It scares me to think that I could lose a lot of information using the Wausau Benefits Web-based Claim Form by hitting the wrong key | | | | | | | | |
| 5. People who influence my behavior think that I should use the Wausau Benefits Web-based Claim Form | | | | | | | | |
| 6. In general, The College of St. Scholastica has supported the use of the Wausau Benefits Web-based Claim Form | | | | | | | | |
| 7. I will find the Wausau Benefits Web-based Claim Form useful in my job | | | | | | | | |
| 8. I have the knowledge necessary to use the Wausau Benefits Web-based Claim Form | | | | | | | | |
| 9. Working with the Wausau Benefits Web-based Claim Form is fun | | | | | | | | |
| 10. Using the Wausau Benefits Web-based Claim Form will enable me to accomplish tasks more quickly | | | | | | | | |
| 11. The Wausau Benefits Web-based Claim Form is somewhat intimidating to me | | | | | | | | |
| 12. I could complete a job or task using the Wausau Benefits Web-based Claim Form if I had just the built-in help facility for assistance | | | | | | | | |
| 13. My interaction with the Wausau Benefits Web-based Claim Form will be clear and understandable | | | | | | | | |
| 14. My use of the Wausau Benefits Web-based Claim Form would be voluntary (as opposed to required by superiors/job) | | | | | | | | |

| | 1 Strongly Agree | 2 Agree | 3 Somewhat Agree | 4 Neither Agree nor Disagree | 5 Somewhat | 6 Disagree | 7 Strongly Disagree | Not Applicable |
|---|---|---|---|---|---|---|---|---|
| 15. I could complete a claim using the Wausau Benefits Web-based Claim Form if I could call someone for help if I got stuck | | | | | | | | |
| 16. I will find Wausau Benefits Web-based Claim Form easy to use | | | | | | | | |
| 17. The Wausau Benefits Web-based Claim Form makes work more interesting | | | | | | | | |
| 18. A specific person (or group) is available for assistance with difficulties using the Wausau Benefits Web-based Claim Form. | | | | | | | | |
| 19. Although it might be helpful, using the Wausau Benefits Web-based Claim Form is certainly not compulsory in my job. | | | | | | | | |
| 20. My superiors expect me to use the Wausau Benefits Web-based Claim Form | | | | | | | | |
| 21. I feel apprehensive about using the Wausau Benefits Web-based Claim Form | | | | | | | | |
| 22. I have the resources necessary to use the Wausau Benefits Web-based Claim Form | | | | | | | | |
| 23. If I use the Wausau Benefits Web-based Claim Form, I will increase my chances of getting a raise | | | | | | | | |
| 24. The senior management of The College of St. Scholastica have been helpful in the use of the Wausau Benefits Web-based Claim Form | | | | | | | | |
| 25. Using the Wausau Benefits Web-based Claim Form is a good idea | | | | | | | | |
| 26. I could complete a claim using the Wausau Benefits Web-based Claim Form if there was no one around to tell me what to do as I go | | | | | | | | |
| 27. I intend to use the Wausau Benefits Web-based Claim Form | | | | | | | | |
| 28. Using the Wausau Benefits Web-based Claim Form will increase my productivity | | | | | | | | |
| 29. Learning to operate the Wausau Benefits Web-based Claim Form is easy for me. | | | | | | | | |
| 30. I hesitate to use the Wausau Benefits Web-based Claim Form for fear of making mistakes I cannot correct | | | | | | | | |

| | 1 Strongly Agree | 2 Agree | 3 Somewhat Agree | 4 Neither Agree nor Disagree | 5 Somewhat | 6 Disagree | 7 Strongly Disagree | Not Applicable |
|---|---|---|---|---|---|---|---|---|
| 31. My boss does not require me to use the Wausau Benefits Web-based Claim Form | | | | | | | | |
| 32. I could complete a claim using the Wausau Benefits Web-based Claim Form if I had a lot of time | | | | | | | | |
| 33. It will be easy for me to become skillful at using the Wausau Benefits Web-based Claim Form | | | | | | | | |
| 34. I like working with the Wausau Benefits Web-based Claim Form | | | | | | | | |
| 35. I plan to use the Wausau Benefits Web-based Claim Form | | | | | | | | |

## Social Network Analysis

Below are seven network questions. To the right of each question is the response scale to use in answering the questions. If you do not know an individual listed in the questionnaire, leave your answer blank or enter a 0. If you know the person, please indicate the closest answer by placing a 1 - 7 in the appropriate column.

**Q1: Collaboration/Communication** - How often do you talk with the following people regarding work and what is going on in the organization?

0= I do not know this person
1 = Daily
2 = Weekly
3 = Bi-weekly
4 = Quarterly
5 = Bi-yearly
6 = Yearly
7 = Never

**Q2: Collaboration/Problem Solving:** Who are important sources of professional advice, whom you approach if you have a work-related problem or when you want advice on a decision you have to make?

0= I do not know this person
1 = Extremely important
2 = Important
3 = Somewhat Important
4 = Neither important nor not important
5 = Somewhat not important
6 = Not important
7 = Not important at all

**Q3: Collaboration/Problem Solving:** To whom do you serve as an important source of professional advice, who approaches you when they have a work-related problem or need advice on a decision they have to make?

0= I do not know this person
1 = Extremely important
2 = Important
3 = Somewhat Important
4 = Neither important nor not important
5 = Somewhat not important
6 = Not important
7 = Not important at all

**Q4: Collaboration/Innovation:** How often are you likely to turn to this person in order to discuss a new or innovative idea or business process?

0= I do not know this person
1 = Daily
2 = Weekly
3 = Bi-weekly
4 = Quarterly
5 = Bi-yearly
6 = Yearly
7 = Never

**Q5: Well Being/Friendship:** Please indicate the people you consider to be personal friends, that is, those people you see most frequently for informal activities such as going out to lunch, dinner, drinks, visiting one another's homes, and so on.

0= I do not know this person
1 = Extremely close friend
2 = A close friend
3 = Somewhat close friend
4 = Neither close or not close
5 = Somewhat not close friend
6 = Not a close friend
7 = Not friendly

**Q6: Information Sharing/Access:** When I need information or advice on work-related issues, this person is generally accessible to me within a sufficient amount of time to help me solve my problem?

0= I do not know this person
1 = Extremely accessible
2 = Accessible
3 = Somewhat accessible
4 = Neither accessible nor not accessible
5 = Somewhat not accessible
6 = Not accessible
7 = Not accessible at all

**Q7: Information Sharing/Engagement**: If I ask this person for help with work related issues, I feel confident that he or she will actively engage in problem solving with me.

0= I do not know this person
1 = Extremely confident
2 = Confident
3 = Somewhat confident
4 = Neither confident or not confident
5 = Somewhat not confident
6 = Not confident
7 = Not confident at all

| | Q1 | Q2 | Q3 | Q4 | Q5 | Q6 | Q7 |
|---|---|---|---|---|---|---|---|
| Name 1 | | | | | | | |
| Name 2 | | | | | | | |
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## Survey Feedback

I very much appreciate you taking part in this pilot test. Your feedback will be invaluable to my future research.

Please note any comments you have about the demonstration, the survey questions, or anything that you found confusing.

Please comment on the demonstration:

_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____

Please comment on the Survey:

| Question Section & Number (*i.e. Social Network Analysis, Question 3*) | Comments |
|---|---|
| | |

Other Comments?

_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____

# Appendix B: Alpha University SNA Survey Instrument

## Please provide the following information about yourself:

Name: _____

Age: _____

Gender: _____ Male _____ Female

Job Title: _____

Department/School (Location):_____

How many years have you worked at Alpha University? _____ years

## Please provide the following information about your familiarity with the FMS:

Have you heard of FMS? _____ Yes _____ No
If the answer is No, you do not need to complete this survey.

Have you only heard of FMS by word of mouth? _____ Yes _____ No

Have you attended the FMS briefing seminar? _____ Yes _____ No
If so, when:_____

Have you attended FMS training? _____ Yes _____ No

If no, do you expect to attend FMS training? _____ Yes _____ No

## Finance Social Network Survey

Using the grid on the following pages please answer the four questions below in the context of your overall work environment:

1. Put a line through the row that contains your name.
2. If you know an individual, answer each question using the 1-7 response scale for that question.
3. If you do not know an individual, leave your answers for that row blank.

| | |
|---|---|
| SNA1 | **Communication:** How often do you communicate with this person regarding work and what is going on at Alpha University<br>1 = Never 4 = Monthly 7 = Daily<br>2 = Annually 5 = Every two Weeks<br>3 = Quarterly 6 = Weekly |
| SNA2 | **Innovation:** How often are you likely to turn to this person in order to discuss a new or innovative idea or business process?<br>1 = Never 4 = Monthly 7 = Daily<br>2 = Annually 5 = Every two Weeks<br>3 = Quarterly 6 = Weekly |
| SNA3 | **Q3: Social:** How often do you see this person socially, for informal activities such as going out to lunch, dinner, drinks, and/or meeting outside of work?<br>1 = Never 4 = Monthly 7 = Daily<br>2 = Annually 5 = Every two Weeks<br>3 = Quarterly 6 = Weekly |
| SNA4 | **Q4: Problem Solving:** This person is an important source of professional advice. I approach this person if I have a work-related problem or when I want advice on a decision I have to make.<br>1 = Strongly Disagree 4 = Neutral 7 = Strongly Agree<br>2 = Disagree 5 = Somewhat Agree<br>3 = Somewhat Disagree 6 = Agree |

*Sample SNA Grid:*

| | | Q1 Comm-unication | Q2 Innovation | Q3 Social | Q4 Problem Solving |
|---|---|---|---|---|---|
| **Finance Office** | | | | | |
| Name | Director of Finance | | | | |
| Name | Finance Officer | | | | |
| Name | Finance Assistant | | | | |

## Appendix C: Alpha University UTAUT Survey Instrument

# FMS Project Survey

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**Please provide the following information about yourself:**

Name: _____

Age: _____

Gender: _____ Male _____ Female

Job title: _____

Department/School:_____

How many years have you worked at Alpha University? _____ years

## FMS Project Survey

Below are 36 questions on your use of the FMS Software. To the right of each question is the response scale to use in answering the questions. Please indicate the closest answer based on the knowledge you have today of the FMS Software by placing a tick in the appropriate column from 1 to 7. Tick "do not know" in questions 32-36 only if you do not have any idea how to answer.

| **For each of the statements below, please indicate the extent of your agreement or disagreement by placing a tick in the appropriate column** | **1 Strongly Agree** | **2 Agree** | **3 Somewhat Agree** | **4 Neither Agree nor Disagree** | **5 Somewhat Disagree** | **6 Disagree** | **7 Strongly Disagree** |
|---|---|---|---|---|---|---|---|
| 36. I predict I will use the FMS | | | | | | | |
| 37. People who are important to me think I should use the FMS | | | | | | | |
| 38. It scares me to think that I could lose a lot of information using the FMS by hitting the wrong key | | | | | | | |
| 39. People who influence my behavior think that I should use the FMS | | | | | | | |
| 40. In general, Alpha University has supported the use of the FMS | | | | | | | |
| 41. I will find the FMS useful in my job | | | | | | | |
| 42. Working with the FMS is fun | | | | | | | |
| 43. Using the FMS will enable me to accomplish tasks more quickly | | | | | | | |
| 44. the FMS is somewhat intimidating to me | | | | | | | |
| 45. I could complete a job or task using the FMS if I had just the built-in help facility for assistance | | | | | | | |
| 46. My interaction with the FMS will be clear and understandable | | | | | | | |
| 47. My use of the FMS would be voluntary (as opposed to required by superiors/job) | | | | | | | |
| 48. I could complete a job or task using the FMS only if I could call someone for help if I got stuck | | | | | | | |
| 49. I will find the FMS easy to use | | | | | | | |
| 50. the FMS makes work more interesting | | | | | | | |
| 51. Although it might be helpful, using the FMS is certainly not compulsory in my job | | | | | | | |
| 52. My superiors expect me to use the FMS | | | | | | | |
| 53. I feel apprehensive about using the FMS | | | | | | | |
| 54. If I use the FMS, I will increase my chances of getting a pay raise | | | | | | | |
| 55. The senior management of Alpha University have been helpful in the use of the FMS | | | | | | | |
| 56. Using the FMS is a good idea | | | | | | | |

| For each of the statements below, please indicate the extent of your agreement or disagreement by placing a tick in the appropriate column | 1 Strongly Agree | 2 Agree | 3 Somewhat Agree | 4 Neither Agree nor Disagree | 5 Somewhat Disagree | 6 Disagree | 7 Strongly Disagree |
|---|---|---|---|---|---|---|---|
| 57. I could complete a job or task using the FMS if there was no one around to tell me what to do as I go | | | | | | | |
| 58. I intend to use the FMS | | | | | | | |
| 59. Using the FMS will increase my productivity | | | | | | | |
| 60. Learning to operate the FMS is easy for me. | | | | | | | |
| 61. I hesitate to use the FMS for fear of making mistakes I cannot correct | | | | | | | |
| 62. My boss does not require me to use the FMS | | | | | | | |
| 63. I could complete a job or task using the FMS if I had a lot of time | | | | | | | |
| 64. It will be easy for me to become skillful at using the FMS | | | | | | | |
| 65. I like working with the FMS | | | | | | | |
| 66. I plan to use the FMS | | | | | | | |

| For each of the statements below, please indicate the extent of your agreement or disagreement by placing a tick in the appropriate column | 1 Strongly Agree | 2 Agree | 3 Somewhat Agree | 4 Neither Agree nor Disagree | 5 Somewhat Disagree | 6 Disagree | 7 Strongly Disagree | Do Not Know |
|---|---|---|---|---|---|---|---|---|
| 67. the FMS is not compatible with other systems I use | | | | | | | | |
| 68. I have the knowledge necessary to use the FMS | | | | | | | | |
| 69. A specific person (or group) is available for assistance with difficulties using the FMS | | | | | | | | |
| 70. I have the resources necessary to use the FMS | | | | | | | | |

| | Save More than 10 hours | Save 4 to 10 hours | Save 1 to 4 hours | Will not save time | Add 1 to 4 hours | Add 4 to 10 hours | Add more than 10 hours | Do Not Know |
|---|---|---|---|---|---|---|---|---|
| 36. How many hours per week do you expect that the use of the FMS will save on your current workload? | | | | | | | | |

# Appendix D: Saints College Survey Instrument

Hello:
The purpose of this survey is to understand your intention to use the document image system software. Saints College supports the completion of this questionnaire and will use the data gathered to improve the document image system implementation process. It will take approximately 20-25 minutes to complete the questionnaire.

Your participation in this study is completely voluntary. Your survey responses will be strictly confidential. Your name has been included so that we can better understand Saint College's informal social network. Individualized responses will be seen only by myself and the project manager. Only aggregate data from this research will be published and available publicly.

If you have questions at any time about the survey or the procedures, you may contact Lynne Hamre, doctoral student with the Higher Education Management program at the University of Bath, and CIO at the College of St. Scholastica, Duluth, MN, lhamre@css.edu.

Thank you very much for your time and support. Please start the survey now by clicking on the **Continue** button below.

**Please provide the following information about yourself:**

Name: _____

Age: _____

Gender: _____ Male _____ Female

Job title: _____

Department:_____

How many years have you worked at Saints College? _____ years

## Technology Acceptance Survey

Below are 35 questions on your use of the document imaging system software. To the right of each question is the response scale to use in answering the questions. Please indicate the closest answer based on the knowledge you have today of the document imaging system software by placing a tick in the appropriate column from 1 to 7. Tick "do not know" in questions 32-35 only if you do not have any idea how to answer.

*Note: coding in first column for reference only. Was not included on the original survey. Key is located at the end of this section.*

| | **For each of the statements below, please indicate the extent of your agreement or disagreement by placing a tick in the appropriate column** | **1 Strongly Agree** | **2 Agree** | **3 Somewhat Agree** | **4 Neither Agree nor Disagree** | **5 Somewhat Disagree** | **6 Disagree** | **7 Strongly Disagree** |
|---|---|---|---|---|---|---|---|---|
| *BI2* | 71. I predict I will use the document imaging system | | | | | | | |
| *SI2* | 72. People who are important to me think I should use the document imaging system | | | | | | | |
| *AN2* | 73. It scares me to think that I could lose a lot of information using the document imaging system by hitting the wrong key | | | | | | | |
| *SI1* | 74. People who influence my behavior think that I should use the document imaging system | | | | | | | |
| *SI4* | 75. In general, Saints College has supported the use of the document imaging system | | | | | | | |
| *PE1* | 76. I will find the document imaging system useful in my job | | | | | | | |
| *AT3* | 77. Working with the document imaging system is fun | | | | | | | |
| *PE2* | 78. Using the document imaging system will enable me to accomplish tasks more quickly | | | | | | | |
| *AN4* | 79. The document imaging system is somewhat intimidating to me | | | | | | | |
| *SE4* | 80. I could complete a job or task using the document imaging system if I had just the built-in help facility for assistance | | | | | | | |
| *EE1* | 81. My interaction with the document imaging system will be clear and understandable | | | | | | | |
| *VU4* | 82. My use of the document imaging system would be voluntary (as opposed to required by superiors/job) | | | | | | | |
| *SE2* | 83. I could complete a job or task using the document imaging system only if I could call someone for help if I got stuck | | | | | | | |
| *EE3* | 84. I will find the document imaging system easy to use | | | | | | | |
| *AT2* | 85. The document imaging system makes work more interesting | | | | | | | |
| *VU1* | 86. Although it might be helpful, using the document imaging system is certainly not compulsory in my job | | | | | | | |
| *VU3* | 87. My superiors expect me to use the document imaging system | | | | | | | |
| *AN1* | 88. I feel apprehensive about using the document imaging system | | | | | | | |
| *PE4* | 89. If I use the document imaging system, I will increase my chances of getting a pay raise | | | | | | | |
| *SI3* | 90. The senior management of Saints College have been helpful in the use of the document imaging system | | | | | | | |
| *AT1* | 91. Using the document imaging system is a good idea | | | | | | | |
| SE1 | 92. I could complete a job or task using the document imaging | | | | | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | system if there was no one around to tell me what to do as I go | | | | | | | |
| BI1 | 93. I intend to use the document imaging system | | | | | | | |
| PE3 | 94. Using the document imaging system will increase my productivity | | | | | | | |
| EE4 | 95. Learning to operate the document imaging system is easy for me. | | | | | | | |
| AN3 | 96. I hesitate to use the document imaging system for fear of making mistakes I cannot correct | | | | | | | |
| VU2 | 97. My boss does not require me to use the document imaging system | | | | | | | |
| SE3 | 98. I could complete a job or task using the document imaging system if I had a lot of time | | | | | | | |
| EE2 | 99. It will be easy for me to become skillful at using the document imaging system | | | | | | | |
| AT4 | 100. I like working with the document imaging system | | | | | | | |
| BI3 | 101. I plan to use the document imaging system | | | | | | | |

| | **For each of the statements below, please indicate the extent of your agreement or disagreement by placing a tick in the appropriate column** | **1 Strongly Agree** | **2 Agree** | **3 Somewhat Agree** | **4 Neither Agree nor Disagree** | **5 Somewhat Disagree** | **6 Disagree** | **7 Strongly Disagree** | **Do Not Know** |
|---|---|---|---|---|---|---|---|---|---|
| FC3 | 102. The document imaging system is not compatible with other systems I use | | | | | | | | |
| FC2 | 103. I have the knowledge necessary to use the document imaging system | | | | | | | | |
| FC4 | 104. A specific person (or group) is available for assistance with difficulties using the document imaging system | | | | | | | | |
| FC1 | 105. I have the resources necessary to use the document imaging system | | | | | | | | |

## Legend:

| | |
|---|---|
| PE | Performance Expectancy |
| EE | Effort Expectancy |
| AT | Attitude toward using technology |
| SI | Social Influence |
| FC | Facilitating Conditions |
| SE | Self-Efficacy |
| AN | Anxiety |
| BI | Behavioral intention |
| VU | Voluntariness of Use |
| KP | Key Performance Indicator |

## Social Network Survey

Below are two network questions. Please answer the questions in the context of your overall work environment. Using the list of names, answer each question using the response scale associated with that question. Do not answer for yourself. If you do not know an individual listed in the questionnaire, please leave your answers for that row blank. If you do know the person, please indicate the closest answer by clicking in the appropriate button.

*Note: These questions were each followed by a grid with the scale across the top and the list names in the social network down the first column.*

1. How often do you talk with this person regarding work and what is going on in the organization?

| | Never | Annually | Quarterly | Monthly | Every two weeks | Weekly | Daily |
|---|---|---|---|---|---|---|---|
| *Name 1* | | | | | | | |
| *Name 2* | | | | | | | |
| *Name 3* | | | | | | | |

2. How often are you likely to turn to this person in order to discuss a new or innovative idea or business process?

| | Never | Annually | Quarterly | Monthly | Every two weeks | Weekly | Daily |
|---|---|---|---|---|---|---|---|
| *Name 1* | | | | | | | |
| *Name 2* | | | | | | | |
| *Name 3* | | | | | | | |

# Appendix E: UTAUT Scales

Scales were created for each variable by computing the mean for the set of questions associated with each scale.

| | |
|---|---|
| AN1 | I feel apprehensive about using the document imaging system |
| AN2 | It scares me to think that I could lose a lot of information using the document imaging system by hitting the wrong key |
| AN3 | I hesitate to use the document imaging system for fear of making mistakes I cannot correct |
| AN4 | The document imaging system is somewhat intimidating to me |
| AT1 | Using the document imaging system is a good idea |
| AT2 | The document imaging system makes work more interesting |
| AT3 | Working with the document imaging system is fun |
| AT4 | I like working with the document imaging system |
| BI1 | I intend to use the document imaging system |
| BI2 | I predict I will use the document imaging system |
| BI3 | I plan to use the document imaging system |
| EE1 | My interaction with the document imaging system will be clear and understandable |
| EE2 | It will be easy for me to become skillful at using the document imaging system |
| EE3 | I will find the document imaging system easy to use |
| EE4 | Learning to operate the document imaging system is easy for me. |
| FC1 | I have the resources necessary to use the document imaging system |
| FC2 | I have the knowledge necessary to use the document imaging system |
| FC3 | The document imaging system is not compatible with other systems I use |
| FC4 | A specific person (or group) is available for assistance with difficulties using the document imaging system |
| PE1 | I will find the document imaging system useful in my job |
| PE2 | Using the document imaging system will enable me to accomplish tasks more quickly |
| PE3 | Using the document imaging system will increase my productivity |
| PE4 | If I use the document imaging system, I will increase my chances of getting a pay raise |
| SE1 | I could complete a job or task using the document imaging system if there was no one around to tell me what to do as I go |
| SE2 | I could complete a job or task using the document imaging system only if I could call someone for help if I got stuck |
| SE3 | I could complete a job or task using the document imaging system if I had a lot of time |
| SE4 | I could complete a job or task using the document imaging system if I had just the built-in help facility for assistance |
| SI1 | People who influence my behavior think that I should use the document imaging system |
| SI2 | People who are important to me think I should use the document imaging system |
| SI3 | The senior management of Saints College have been helpful in the use of the document imaging system |
| SI4 | In general, Saints College has supported the use of the document imaging system |
| VU1 | Although it might be helpful, using the document imaging system is certainly not compulsory in my job |
| VU2 | My boss does not require me to use the document imaging system |
| VU3 | My superiors expect me to use the document imaging system |
| VU4 | My use of the document imaging system would be voluntary (as opposed to required by superiors/job) |

**Legend:**

| | |
|---|---|
| PE | Performance Expectancy |
| EE | Effort Expectancy |
| AT | Attitude toward using technology |
| SI | Social Influence |
| FC | Facilitating Conditions |
| SE | Self-Efficacy |
| AN | Anxiety |
| BI | Behavioral intention |
| VU | Voluntariness of Use |
| KP | Key Performance Indicator |

# Appendix F Saints College Research Summary Report

First, thank you for agreeing to participate in this research. Your support is greatly appreciated. I hope you find this information valuable as you continue with the document imaging software implementation and in future technology implementations.

Please remember that this data is confidential and should be not be shared. I would be happy to create network diagrams with names omitted for your use.

*Background*
In May 2007, the Institutional Advancement (IA) Department trained sixteen staff members on the new document imaging solution. IA was one of the first departments trained as Saints College rolled out document imaging software across campus.

These sixteen IA staff members were asked to complete a two part survey: technology acceptance and social network. The technology acceptance aspect of the survey was designed to provide information on the behavioral intention of IA staff to accept and use the document imaging software. Social Network Analysis provides information on the informal social structure of the IA department. Fifteen staff members completed the survey.

*Technology Acceptance Survey*
Staff members were asked to complete thirty-five questions looking at their intent to accept and use the document imaging application. The questions represented several categories that influence intent to accept the technology. These categories are: performance expectancy, effort expectancy, social influence, facilitating conditions, self-efficacy, anxiety, and attitude.

In analyzing the data, it appears that the respondents intend to use the document imaging application. This category was the highest scoring, followed by the social influence and facilitating conditions categories. My interpretation of the data is that the respondents feel that their peers think they should use the document imaging software and there is a support structure in place to support their use of the new tool.

The lowest scoring categories were self-efficacy and anxiety. Both self-efficacy and anxiety are linked to an individual's self-confidence in their ability to use technology to do their jobs and the stress resulting from that. Neither of these categories have been proven in past research to significantly impact an individual's intent to use a new technology.

*Social Network Survey*
Staff members were asked to identify their interactions with other members of the IA department. This data was analyzed using social network analysis to identify individuals who are central in the organization, therefore possessing social capital. These staff members are looked upon by other members of the social network as prestigious and prominent members of the department.

The top five individuals in order of centrality measures are:

1. Name 1
2. Name 2
3. Name 3
4. Name 4
5. Name 5

The following diagrams illustrate interactions among the IA staff that occur at least every two weeks and more frequently.

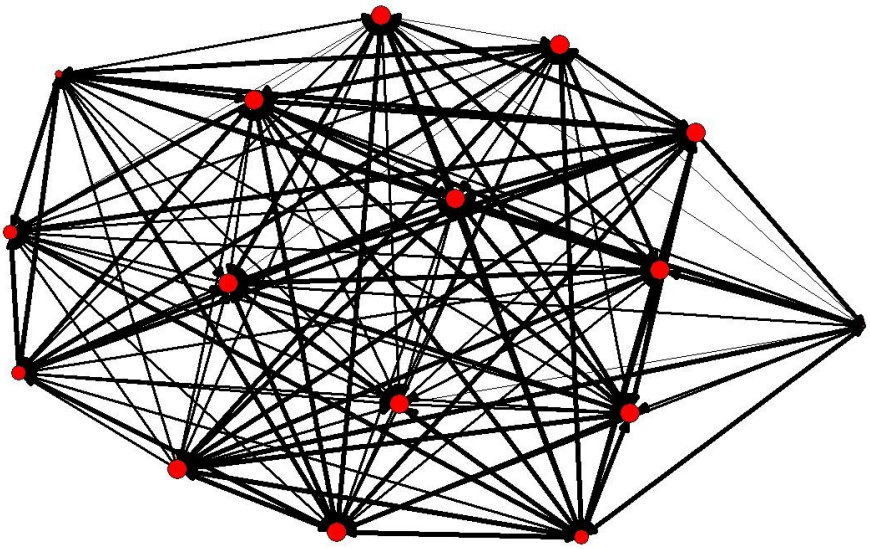

**Figure 1** - How often do staff talk with each other regarding work and what is going on in the organization.

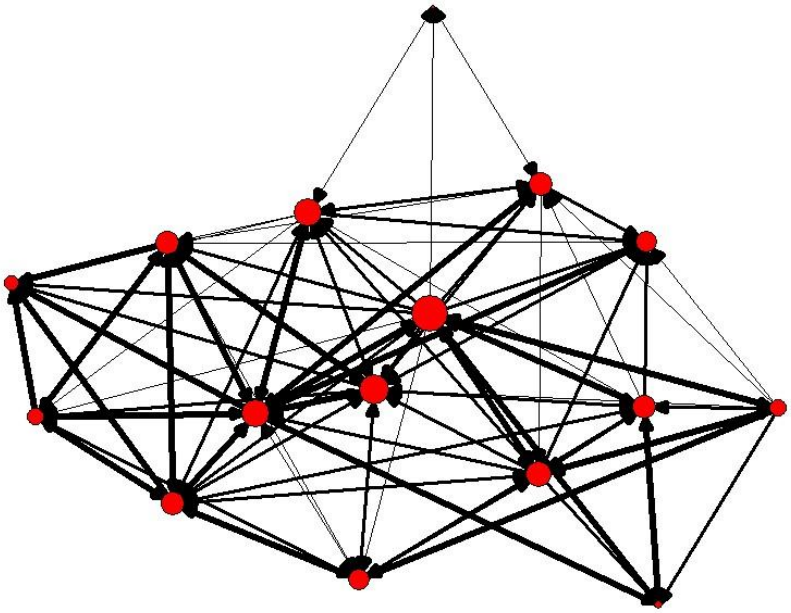

**Figure 2** - How often are staff likely to turn to each other in order to discuss a new or innovative idea or business process.

*How to use this information*

This data provides valuable information for the document imaging software project and future technology implementations. The data shows a strong behavioral intention to use the document imaging software as well as the perception that those that people look up to may want them to use the technology and a support infrastructure exists if they need it. There seems to be some amount of anxiety over using the technology and a lack of self-confidence that they will be successful in the use of the document imaging software. You may want to take this into account as you move forward with the implementation. You may want to celebrate and highlight individual successes to help build confidence and talk with the staff about the technology to help relieve anxiety.

The social network data provides information on the most central individuals in the Institutional Advancement Department's informal social structure. Saints College could leverage the prestige and social capital of these individuals by empowering them to be champions for change on behalf of document imaging project and future change processes.

This group could also serve as a reference group for the technology implementation to share information with others or to find creative ways to use the technology to improve processes.

*Conclusion*

Thank you again for participating in this research. Please let me know if you have any questions or would like to go into more detail as to the results of this survey. I will be happy to share the data files with you if you would like them for further analysis.