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The Impact of User Involvement on Information System Projects

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THE IMPACT OF USER INVOLVEMENT ON INFORMATION SYSTEM PROJECTS

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ABSTRACT

Information systems (IS) development has been studied from many perspectives. Information systems are being viewed as a service as the economy shifts from being industrial-based to service-based. This shift is motivating the business user to become more involved with the development of the system. The once clear roles of user-as-specifier and IT professional-as-developer are blurring.

This research addresses three objectives. First, we survey the actual business users themselves for their perception of activities and satisfaction with the completed system. Second, we analyze the separation of business requirements into two constructs representing the functional and presentation dimensions of these requirements to advance our understanding of user involvement on information system projects. Third, we explore the combinations of user characteristics and their activities that can improve IS project performance.

A new comprehensive model is proposed to represent the business user as an active participant in system development. A survey instrument is developed from a widespread literature review of IS project performance, user involvement and project management. The instrument was tested to ensure its ease of completion and its comprehensibility.

The revised instrument was sent to 3,419 U.S. business users in multiple industries from which 205 valid surveys were received. Structural Equation Modeling was used to validate the measurements and analyze the hypotheses and the overall model. The results confirm some previous findings and document new discoveries regarding the users, their activities and the impact on user satisfaction.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF EQUATIONS

CHAPTER I

INTRODUCTION

I.1 Background

The search for critical success factors in information system (IS) development projects has been active for many years and has traversed industries, geographies and technologies. Specifically, user involvement (UI) and user participation (UP) on information system projects have been researched for over 30 years. Melville, Kraemer, and Gurbaxani (2004) argue that the use of information technology is beneficial to organizational performance. There is a general assumption that UI of some sort is beneficial to project success[1] (Nah and Delgado, 2006; Wagner and Piccoli, 2007; Saleem, 1996) even to the point of calling it an "institutionalized practice" (Howcroft &

[1] Although project success is in theory an economic construct, defining the construct is in itself difficult due to the challenge of valuing intangible costs and benefits (Ives et al, 1983). A detailed study of this construct is outside the scope of this paper.

Wilson, 2003), an "ethical imperative" (Sashkin, 1984) and "an axiom of the MIS literature that user …[participation] is a necessary condition for successful development" (Ives & Olson, 1984). Numerous studies have noted that user involvement (UI) and user participation (UP) are significant factors affecting project outcomes (Kappelman, McKeeman and Zhang, 2006; Khang and Moe, 2008; Ngai, Law and Wat, 2008; LePage, 2009). The lack of UI has even been identified as contributing towards a troubled project (Havelka & Rajkumar, 2006). Some studies indicate insignificant or even contradictory findings caused by methodological differences, varying construct definitions, and poor theory development (McKeen, Guimaraes and Wetherbe, 1994; Ives and Olson, 1984; Locke, Schweiger and Latham, 1986; Gemino, Reich and Sauer, 2008). Millerand and Baker (2010, p. 137) state "that the user concept itself is underdeveloped in theory". Locke et al (1986, pp. 65-66) say that "[user] participation is a tool, not a panacea". Colorful references can be found describing the interactions between project team members as "a ritual dance of successive approximation to the required product" (Boddie, 1987); another describes "the merits of user participation [having] as much clarity as would a law of gravity stating that a falling object may sometimes come down, occasionally go up, and periodically drift to the side" (Saleem, 1996, pp. 145-146). Even more damaging to the common assumption that UP positively impacts project success are studies suggesting that user involvement may actually worsen project outcomes (Brodbeck, 2001; Heinbokel, Sonnentag, Frese, Stolte and Brodbeck, 1996).

Recent research by Hsu, Hung, Chen, and Huang (2013) is beginning to consider IS development from a service provider perspective as consumers have become more involved with the design, development, and implementation of these systems. This shift from a goods-dominant focus (manufacturing of a product) to that of a service-dominant focus (service as a process with dynamic resources and the valuing of customer coproduction) follows the last century's move from an industrial economy to that of a service economy. The assumption of such a shift is that the final system quality would be a function of the extent to which business users actively engage with the system development team throughout the development process. This shift can be seen in the research as more articles are being published in the last 10 years that address business user involvement (see Table VIII, Table IX, Table X, and Table XI). Over 87% of the findings reviewed for this research support a positive relationship between business user involvement and project success.

User involvement in information systems development efforts may begin by assuming that such participation will provide valuable input to various technical decisions to be made. However, their participation may have a greater value because those decisions are more socio-technical than purely technical (Damodaran, 1996; Wang, Shih, Jiang and Klein, 2006). Based on inconsistent findings from 89 studies using multiple methodologies, Doll and Torkzadeh (1989, p. 1157) argue that more complex model(s) must be employed to describe the relationship between user involvement and user satisfaction. An early meta-analysis of 22 papers by Ives and Olson (1984, p. 586) finds that the papers in their study were "poorly grounded in theory and methodologically flawed". Recent meta-analysis of 82 papers found that UP may only be minimally-to-moderately beneficial to system development projects with the dominate influence being on attitude and behavioral changes rather than productivity (He & King, 2008). Harris and Weistroffer's (2009, pp. 751-752) meta-analysis of 28 papers finds support for user involvement positively impacting user satisfaction which they argue is a proxy for system success.

There is a common assumption among practitioners that users who begin projects with beliefs that the system will be beneficial to them will engage in activities to ensure success (Ginzberg, 1981). Early empirical studies suggest that users followed a push-oriented technology-centered approach, notably Hartwick and Barki (1994) and Ives and Olson (1984). Recent studies are finding that users are shifting from that approach to a more crucial pull-oriented, user-driven approach (De Moor, Berte, De Marez, Joseph, Deryckere and Martens, 2010). There are many prerequisite conditions, factors and moderators that affect effective user participation. Prior research has employed a wide variety of construct definitions, methodologies and metrics which themselves cause inconsistent findings (Ives & Olson, 1984). Multi-domain studies involving new product development, psychology, organizational behavior and marketing have deepened our understanding. Research on this topic has advanced by improving construct definitions, identifying moderating and mediating factors, developing process models, and performing longitudinal studies to observe the processes in practice.

I.2 Foundations and Definitions

This section introduces the theory of user involvement and establishes a number of definitions for critical objects used in this research. Differences in these definitions have been a cause of numerous research efforts to report conflicting results, therefore having standard definitions is crucial to this and future research.

I.2.1 Information Technology

Leavitt and Whisler (1958) coined the term “Information Technology” (IT) in their Harvard Business Review article. Their definition focuses on the behavior of the technology; for example, processing large amounts of data quickly using high speed computers by the application of statistical and mathematical methods to decision making. Ayeni (2008, p. 523) defines Information Technology (IT) as incorporating “a wide range of technologies like telephone computer word processing applications, web browsers and servers and full text document databases and mainframe computers.” Weill and Broadbent (1998) define IT as

> a firm's total investment in computing and communications technology; this includes hardware, software, telecommunications, the myriad of devices for collecting and representing data, all electronically stored data, and the people dedicated to providing these services. It includes the information technology investments implemented by internal groups (insourced) and those outsourced by other providers.

Luftman, Lewis and Oldach (1993, p. 201) define IT as

> the rapidly expanding range of equipment (computers, data storage devices, network and communications devices), applications [such as distribution, education, manufacturing, retail and travel] and services (e.g. end-user computer, help desk, application development) used by organizations to deliver data, information and knowledge.

They are predominantly general purpose components used in various combinations and degrees to accomplish specified objectives.

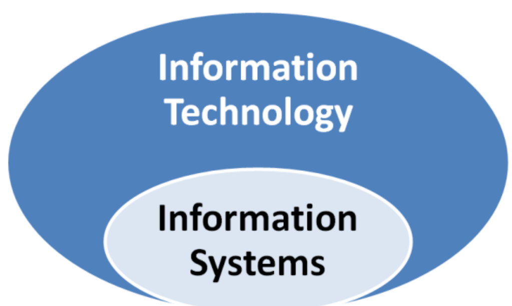
I.2.2 Information Systems

Laudon and Laudon (2005, p. 8) define an Information Systems (IS) as

> a set of interrelated components that collect (or retrieve), process, store, and distribute information to support decision making and control in an organization. In addition to supporting decision making, coordination, and control, information systems may also help managers and workers analyze problems, visualize complex subjects, and create new products.

Mursu, Luukkonen, Toivanen and Korpela (2007) define IS "as the use of information technology (manual or computer-based) in a collective work activity, either as a means of work or of co-ordination and communication." Currie and Galliers (1999, p 7) state that "an information system is an instantiation of information technology, where the same information technology can be instantiated in different ways." This leads to an understanding of IS as being a subset of IT as shown in Figure 1.

Figure 1: IT and IS



I.2.3 Users

I.2.3.1 User Involvement

User Involvement (UI) "refers to a subjective psychological state of the individual and [is] defined as the importance and personal relevance that users attach either to a particular system or to IS in general, depending on the user's focus" (Barki & Hartwick, 1989, pp. 59-60). Subsequent research has confirmed this definition and empirically supported this separate construct (Hartwick and Barki, 1994; Kappelman and McLean, 1992).

I.2.3.2 User Participation

User Participation (UP) refers "to the behaviors and activities that the target users or their representatives perform in the systems development process" (Barki & Hartwick, 1989, p. 59). This is consistent with the proposal by Kanungo (1979, 1982) with respect to organizational behavior. Later research supported this definition via an empirical study (Hartwick & Barki, 1994). Elsewhere, UP is defined as "those democratic processes that enable employees to exercise control over their own work environments and work futures" (Mumford, 1983, p. 48). Chen, Liu and Chen (2011) suggest that significant components of UP can provide further insights into the impact of user participation, such as user influence (decision-making capabilities) positively impacting IS process quality. Locke et al (1986) contrast user participation (seen as joint decision making) with authoritative decision making and delegation (management making unilateral decisions and employees making unilateral decisions, respectively).

I.2.3.3 User Attitude

User Attitude refers "to a psychological state reflecting the affective or evaluative feelings concerning a new system" (Barki and Hartwick, 1994a, p. 62). The user's attitude can either be favorable or unfavorable and suggests the need to separate the evaluative, or attitude, measures from the involvement construct (Zanna & Rempel, 1988).

I.2.3.4 User Advocacy

Bettencourt, Ostrom, Brown and Roundtree (2002, p. 108) define user advocacy as "the extent to which the client lead acts as a vocal advocate and salesperson for the project and its merits within client firm." Wang, Chang, Jiang and Klein (2011) use this concept in their matched-pair survey of project performance. Their model supports both user socialization and extrinsic motivation as antecedents to user advocacy.

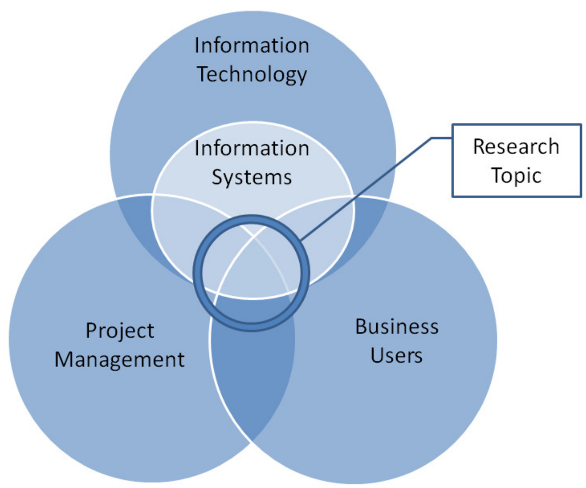
I.2.4 User Satisfaction

The literature includes many studies of information system development using various dependent variables to represent project success, project performance, or user satisfaction. All articles in our review of 64 empirical studies show that they designated project success, project performance, user satisfaction or system usage as the dependent variable (Table X). Robey, Smith and Vijayasarathy (1993, p. 137) note that project success is often defined without clarity. Harris and Weistroffer's (2009) meta-analysis states that user satisfaction is a proxy for system success. Traditional concepts of project performance have focused on the "triple constraint" of budget, schedule and scope. Therefore, we include multiple measures of user satisfaction from the literature to be able to understand the user's perception of this outcome measure.

I.3 Research Scope and Objectives

Project Management is a well-studied research topic; it is "the application of knowledge, skills, tools and techniques to project activities to meet the project requirements" (Project Management Institute, 2008, p. 443). The purpose of information systems is to generate improvements for the affected users and their firms; since they are the beneficiaries, the affected users are often engaged to varying degrees throughout the project life cycle in an attempt to increase the value of the final product or service. With the rise of information systems (IS) and the rapidly changing underlying technologies, this specific project management domain has received a great amount of attention with entire methodologies focused specifically on information system projects. This study's focus is the intersection of project management, information systems and user involvement on projects with the intent to reconcile differences between the studies and develop a more comprehensive model of business user involvement on IS projects as measured in three performance models (see Figure 2).

Figure 2: Research Scope



I.4 Research Questions

The extant research indicates that some level of user involvement and participation in IS projects positively impacts their success although some early research generated indecisive results and contradictory findings. As research progressed to recognize the influence of Participatory Design integrating a social dimension along with technical factors, one could expect to find models that increase the explanation of significant variables due to improved factor selection, improved modeling and methodology, and advancement in amalgamating research findings. However, current research still indicates supportive, non-supportive and contradictory results while using models not fully incorporating prior findings. McKeen and Guimaraes (1997, p. 148), Millerand and Baker (2010, p. 138) and Chen et al (2011) recommend additional direct and indirect factors to their models to improve the representation of project success. Robey, Smith and Vijayasarathy (1993, p. 137) note that project success is often defined without clarity. Saleem (1996, p. 146) argues for the use of objective measures of project success. Further, IS requirements as defined by international standards organizations[2] conflict with how current literature segregates those requirements into two categories (refer to Sections V.2.2.1 and V.2.2.2 for this analysis).

The specific questions being addressed by this research include:

- *What influence do the various characteristics of a business user have on user activities?*
- *Can business requirements be modeled differently to better represent the activities performed by business users?*
- *What combinations of user characteristics and user activities have the greatest impact on each measure of user satisfaction?*

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[2] International standards organizations typically communicate industrial, cultural, or technical measures in an attempt to facilitate commerce. Major organizations include International Organization for Standards (ISO), American National Standard Institute, Institute of Electrical and Electronics Engineers (IEEE), and Project Management Institute (PMI).

This research explores a multi-factor model of business user involvement in information system projects to identify how specific user characteristics and activities impact various user satisfaction measures. The study distinguishes various roles that users may perform on IS projects to provide empirical evidence of the correlations between these roles and user satisfaction with the project. It acknowledges that the user's most important contribution to an IS project is the provision of business requirements while incorporating other significant user activities as identified in literature. This research is the first empirical model to measure a business user's involvement in the gathering of information system requirements by defining two separate constructs: functional requirements (business processes, data storage, calculations, security, and task complexity) and presentation requirements (the design of forms, screens, reports, and queries). The model also includes constructs for quality assurance and project management activities. We incorporate multiple objective measures of project success to improve the model's validity. Although we acknowledge the significant contribution the IS team makes to the delivery of the finished product or service, we focus our research on business user involvement.

The sample frame for this research is intentionally focused toward business users so that their perceptions of their activities and satisfaction are measured directly rather than through intermediaries such as information system professionals. This research contributes to the literature by the use of a more comprehensive model to study the simultaneous impacts of multiple user activities on user satisfaction. User satisfaction is examined using multiple measures that address various dimensions of user satisfaction. Our understanding of business requirements on information systems is enhanced as a result of empirically studying the constructs suggested by literature. Finally, the analysis is generally applicable due to the large sample across multiple industries.

I.5 Dissertation Outline

This dissertation is designed to explore business user involvement on information system projects. It is organized as follows: Chapter 1 provides an introduction to the research with foundational information and definitions, and the research scope, objectives, and questions. Chapter 2 synthesizes the available literature to highlight various characteristics of the research including a summary of the theoretical and empirical studies. Chapter 3 explores the domains that have studied user involvement to identify pertinent research. Chapter 4 summarizes the literature in a manner that focuses on our research questions. Chapter 5 develops the Multiple Factor User Satisfaction model by describing the constructs and their relationships. Chapter 6 describes the methodology of the empirical study including the design, sampling plan, analysis approach and structural equation modeling. Chapter 7 details the results of the analyses. Chapter 8 discusses the findings and provides managerial implications. Chapter 9 summarizes and concludes the research.

CHAPTER II

LITERATURE REVIEW

The literature review for this research supports Ives & Olson's (1984, p 600) statement that "the benefits of user involvement have not been strongly demonstrated". Numerous studies of this topic have been performed in the last thirty years on this topic that generally support the benefits of user involvement, but there are still a number of studies that report insignificant or conflicting results (Table XI).

II.1 Literature Review Methodology

This section is motivated by Liston (2006) which provides a methodology for proper literature review that progresses in phases from "initial", through "exploratory" and "focused" and finishing with "refined". The results of the review (detailed in the next paragraph) allowed us to (1) define the current state, (2) identify the research gap, (3) support methodological choices and (4) discuss results (Chenail, Cooper and Desir, 2010).

During the "initial" stage, we electronically searched available research databases using specific keywords (such as "customer involvement", "customer participation", "user involvement" and "user participation") without time period constraints. Other keywords were used to identify studies of specific content (such as "IS project management"). The research databases included (but were not limited to) Academic Search Complete, Academic Search Premier, Business Source Complete, Business Source Premier, Computer Source and Computers and Applied Sciences Complete. In the second "exploratory" stage, we used citations to and from selected articles as further sources. This method provided over 270 refereed, concise and up-to-date journal articles and research books that provide the basis of this research. The third "focused" stage was the initial categorization and summarization of the papers based on their findings and research methodologies as well as removing papers that did not directly correspond to this research. This stage produced the subject areas for the literature review, analysis and summary; it also identified areas requiring additional search efforts to ensure thorough treatment of each subject area. Lastly, the "refined" stage performed the additional literature searches and final analysis of the selected papers. There are 227 papers in the final complete literature review.

II.2 Purpose of User Involvement

Early research by Swanson (1974, p. 178) identifies the "popular wisdom" that "management should be 'involved' in MIS development … Unfortunately, what is meant by involvement is rarely clear". The author did suggest that the measurement of involvement should be based on their activities whether as a user or as a facilitator of its development. Ten years later, Ives and Olson (1984) retain that view in their critical study of user involvement. The authors separate the degree of participation from the type of participation but note the research needs to develop a standard measure of user involvement. The Standish Group (PM Hut, 2009) periodically surveys project success and consistently finds that more projects are deemed to be failures than successes. Verner, Cox, Bleistein and Cerpa (2005, p. 226) note that the Standish Group has often cited the lack of user involvement as a contributor to the high number of failures[3]. Their study shows that a high level of customer involvement is the best predictor of project success (ibid, p. 231); although their study included a number of dimensions, budget was specifically excluded from their analysis (ibid, p. 235).

Ewusi-Mensah and Przasnyski (1991) studied project abandonment along three dimensions in the search for significant causes; they specifically studied economic, technical and organizational factors where organizational factors were further sub-divided into corporate management, end user, and IS professional. Although their study is exploratory in nature, they find "that project abandonment is a distinct possibility even in development situations where active end-user participation is the norm" (ibid, p. 81). Yetton et al (2000) find empirical support for much of the Ewusi-Menseh and Przasnyski research, especially that "user participation increases the likelihood that the project is completed and not redefined or abandoned" (ibid, p. 277).

[3] PM Hut (2009) notes that recent Standish CHAOS reports indicate a long-term trend of increasing project success possibly due to better project management expertise (more certified project managers), better training, and better tools and techniques. However, the majority of projects are still classified as failures.

II.3 Users and IS Projects

II.3.1 User Roles in IS Projects

User roles (the titles, positions, or responsibilities held on projects) are generally not well understood. Leonard (2004, p. 19) notes that users are often regarded as "an inferior party" by IT professionals. Iivari, Isomaki and Pekkola (2010, p. 112) reduce the user role to that of a static entity, a source of individual task productivity, regardless of how the user is defined. This may be compelling for research because of its simplicity, but it ignores social, organizational and technical factors. The development and deployment of IS affects both the technical and social dimensions of organizations (Robey & Markus, 1984). Amoako-Gyampah and White (1997), Reich and Wee (2006) and Kappelman et al (2006) note that the various IS roles, unless clarified, can confuse the users. Tesch, Kloppenborg and Frolick (2007) state that clarifying roles and responsibilities of users reduces project risk by identifying inadequate resource levels or skills. Jiang and Klein (2000) argue that a lack of clearly defined roles and general user expertise negatively impact project success. Hsu, Chan, Liu and Chen (2010) note that effective UI (as measured by "quality interactions" that allow users some level of control over the development process) influences project outcomes. Similarly, Chen et al (2011) and Havelka and Rajkumar (2006) note that ambiguous role definitions may negatively impact UP. As a result, research efforts have been made to improve the basic constructs of a user's role.

Users can be portrayed by the function they perform throughout the project life cycle. Ives and Olson (1984) identify two roles: primary users (use the output) and secondary users (generate input or run the system). Damodaran (1996) identifies multiple user roles: resource pool of user expertise, “Top management”, “Middle management”, user representatives and end-users. Mahanti (2006) identifies a number of stakeholders including executives, middle management, customers, developers, testers, analysts, finance personnel, and HR representatives. Kearns (2007) exclusively studies the executive manager. Keil and Robey (1999) studied how troubled software development projects became troubled projects. They identified six roles that helped trigger de-escalation of the project’s priority: top management, internal IS auditor, external auditor / consultant, IS users, IS project team member and IS management. Howcroft and Wilson (2003) suggest three roles in participatory practices: manager, employee and developer. Tudhope, Beynon-Davies, and Mackay (2000) identify various user roles within the rapid application development methodology; these include the executive sponsor, visionary (business analyst), ambassador (user representative) and advisor (end users). A study of enterprise resource planning system implementations promotes two types of external roles: consultant and vendor (Wang, Shih, Jiang and Klein, 2008). Developers can state that they try to keep user requirements in mind while they work, but this has been deemed to be insufficient in practice (Iivari, 2009). Jiang, Sobol, and Klein (2000) study of project risks used three types of constituents: management, users and IT staff. Upton and Staats (2008) emphasize the importance of CEO-level involvement in strategic IT projects. Kamadjeu, Tapang and Moluh (2005) document the significance of executive sponsorship and support on overall project success. However, Biffl, Winkler, Hohn and Wetzel (2006) note that extra effort may be necessary to mentor loosely engaged executives into becoming active participants. Wu and Wang (2006) list four user roles in their study of ERP project success: managers and stakeholders, customers, suppliers, and employees.

Millerand and Baker (2010) argue that user and developer roles are not static and should not be defined as such no matter how convenient for the researcher. They draw on organizational theory which acknowledges that users can have multiple simultaneous roles which they identify as user representatives, co-developers, and co-users. This multiple role play is designated "enactment" in their theory development section which contributes to their Integrative Design Model. Further, these users can have multiple relationships that include objects, actions and settings.

Terry (2008) reports on a survey of e-commerce projects that highlights new characteristics of users given the advent of e-business / internet technologies. The study of forty four recently completed projects considers a new user type named "customer-users" described as

> remote customers who may not be known to the organization. They are the ultimate end-users, but are beyond the accepted definition of users … They are not staff and do not fall under the control structures of the organization. … Their participation cannot be mandated (ibid, p. 199).

Table 1 provides a summary of user roles. The most frequently studied roles are internal user roles such as users, customers, management, and representatives. The two roles that are noted in more than half of the papers surveyed are users and executive management. These separate roles are important to IS practitioners because the communication provided to each group varies based on their information needs and their potential level of influence on the project. The second most studied roles are internal information system staff such as developers, testers, analysts, and project managers. Additional internal and external roles are also noted but to a lesser degree. On the average, a typical paper investigated between 2 to 3 roles. The specific columns and groupings in this table were determined after a review of the literature. Since the literature noted internal and external roles that incorporated both users and IS staff, we included all roles to properly represent the literature.

Table I: User Roles in IS Projects

	Internal								External
	User Roles				Information Systems Staff			Other	
	Users, Customers, Experts	User Representatives	Executive Mgmt, Sponsor	Middle Mgmt	Developers, Testers	Analysts	Project Mgmt	Finance, HR	Vendor, Auditor, Consultant
Biffl et al (2006)	X		X						
Damodaran (1996)	X	X	X	X					
Hoda, Noble and Marshall (2011)	X								
Howcroft and Wilson (2003)	X		X	X	X	X			
Iivari (2009)					X				
Ives and Olson (1984)	X			X					
Jiang et al (2000)	X		X		X				
Jones (2003)					X				
Kamadjeu et al (2005)			X						
Kearns (2007)			X						
Keil and Robey (1999)			X		X	X	X		X
Kelly (2011)	X								
Khang and Moe (2008)	X	X	X	X	X	X	X	X	
Lawrence and Low (1993)		X							
Liu, Zhang, Keil and Chen (2010)	X		X						
Mahanti (2006)	X		X	X	X	X		X	
Melton et al (2010)	X								
Ngai et al (2008)			X						
Siakas and Siakas (2007)	X								
Sioukas (1994)	X								
Somers and Nelson (2001)			X		X	X	X		X

	Internal								External
	User Roles				Information Systems Staff			Other	
	Users, Customers, Experts	User Representatives	Executive Mgmt, Sponsor	Middle Mgmt	Developers, Testers	Analysts	Project Mgmt	Finance, HR	Vendor, Auditor, Consultant
Somers and Nelson (2004)			X				X		X
Terry (2008)	X								
Tudhope et al (2000)	X	X	X			X			
Upton and Staats (2008)			X						
Wang et al (2008)			X						X
Wu and Wang (2006)	X								X
References: number of studies / frequency (%) of studies	16 / 59.3%	4 / 14.8%	16 / 59.3%	5 / 18.5%	8 / 29.6%	6 / 22.2%	4 / 14.8%	2 / 7.4%	4 / 14.8%
	25 / 92.6%				10 / 37.0%			2 / 7.4%	4 / 14.8%

II.3.2 User Activities in IS Projects

User activities are often loosely defined and not well integrated towards project success (Amoako-Gyampah and White, 1997). Although Ariyachandra and Frolick (2008) note the need for specific assignments and responsibilities in their study of critical success factors in business performance management projects (which typically have a broader scope than IS projects – ibid, p. 114), Ives, Olson and Baroudi (1983) find UP to be significant but their study does not specify what defines user participation. Damodaran (1996) notes that these roles must provide detailed knowledge, highlight strategic issues, manage their time and level of commitment and participate in quality assurance activities. The author further characterizes user involvement in three forms: informative (users provide and/or receive information), consultative (users comment on a predefined service or range of facilities), and participative (user influence decisions relating to the whole system). Iivari (2009) characterizes participatory activities as being direct or indirect.

White and Leifer (1986) study IS project activities based on task routineity by using a Jungian typology to identify selected dimensions of a person's personality types (specifically the dimensions of sensing / intuition and thinking / feeling) and whether the necessary skills are classified as technical or process. They find that a range of technical and process skills are perceived as being important to success and that the importance of each skill can vary from one phase to another. They also find that the tasks in each succeeding project phase became more routine. This supports the idea that different phases may need to be managed differently or require different skill sets.

Leonard (2004) identifies two dimensions of the information technology / end user relationship: the physical dimension encompasses tactical characteristics such as procedures, people, structures and technology, whereas the abstract dimension includes characteristics such as a knowledge base, commitment, and supportive culture. McKeen and Guimaraes (1997) study strategies for user participation and identify five "basic core" activities: approving information requirements, defining data I/O forms, screens and report formats, and assisting in installation activities. They also note that there could be additional activities but such activities would be unique to the need for participation. Barki, Titah and Boffo (2007) identify three behaviors based on an activity theory perspective: technology interaction (IT interactions to accomplish a task), task-technology adaptation (behaviors motivated to change both the information technology and the deployment and use within an organization), and individual adaptation (learning, both formal and informal, accomplished through communication and independent exploration). Fang (2008) suggests two factors of customer participation: their role as an information resource and their role as a co-developer. Based on an exploratory research effort, Kristensson, Matthing and Johanson (2008) suggest that the role of co-creator ("collaboration with customers for the purposes of innovation"), analogous to co-developer, is a significant activity. Terry (2008, p. 206) states that "the once clear roles of user as specifier [sic], and IT professional as developer of systems" have been blurred.

Multiple studies identify user participation as contributing to the generation of correct system specifications, enabling relevant designs and providing the users with a sense of ownership of the results (Chen et al, 2011; Kelly, 2011; Huang and Kappelman, 1996). Schummer, Lukosch and Slagter (2006) find that requirements are more sensitive to their business value and completeness when the system being designed is less structured by nature, such as for groupware. Chakraborty, Sarker and Sarker (2010) find that complex functional requirements are a primary inhibitor to analyzing ("sense-making") and problem resolution ("dissention"), and a secondary inhibitor to scoping. McKeen et al (1994, p. 443) find that higher levels of task complexity indicates a need for greater levels of user involvement. Sudhakar, Farooq and Patnaik (2012) find that task complexity impacts software development team productivity. Harris and Weistroffer (2009) suggest that system complexity increases the need for increased UI to capture the right requirements. They further identify five core user activities: (1) feasibility analysis, (2) determine information requirements, (3) define input and output forms, (4) define screen and report formats, and (5) install the system. Ravichandran and Rai (2000) note the value of user involvement within their focused study of total quality management on IS projects. Kristensson et al (2008) argue that the process of discovering business requirements in technology-based service companies face unique challenges. These firms often have few face-to-face relationships which limits their ability "to communicate with their customers, observe them in different situations, and receive complaints about service failures" (ibid, p. 478). Additionally, "most users of technology-based services have limited technical knowledge [and] are often unable to foresee (and/or articulate) their ideas about innovative services that would create surplus value for them" (ibid, p. 478).

International standard organizations typically do not separate types of requirements although they may detail various attributes or dimensions of requirements. For example:

- ISO 9001 certification has no division between types of requirements as suggested in the literature
- Capability Maturity Model Integration (CMMI) does not differentiate between types of requirements but does separate product and product component requirements (Carnegie Mellon University, 2010)
- The Project Management Institute does not differentiate between types of requirements (Project Management Institute, 2008)
- The Guide to the Software Engineering Body of Knowledge (IEEE, 2012, Chapter 2) defines functional requirements (functions that the software is to execute) and non-functional requirements (requirements that tend to constrain the solution)

Corollary types of involvement have also been identified. McFarlan and McKenney (1983) identify the need for users to be cognizant of their total financial expenditures and the support plan for their system once implemented (such as response times, disaster recovery requirements and methods, training, and network architecture). Coombs, Doherty and Loan-Clarke (2001) studied user ownership that includes factors representing various project best practices[4]. They find that projects adopting many of the best practices, especially those practices that are user related, have greater perceptions of project success. Additionally, projects lacking the application of best practices were inhibited from developing user ownership. Finally, they note a positive relationship between the adoption of best practices and user attitudes.

Table 2 summarizes the activities noted in the surveyed literature. The top two activities studied in more than half of the papers surveyed focus on providing the business requirements including functional requirements and presentation requirements (forms, screens, reports and queries). Twenty eight of 31 articles (90.3%) studied either requirements management and/or quality assurance activities. On the average, a typical study investigated between 2 to 3 user activities.

Table II: User Activities

	Requirements		Quality Assurance				Other			
	Provide functional requirements #	Define Forms, Screens, Reports and Queries	Prototype	Plan, Coordinate, Problem Solve	Risk Management	Test / Validate	Assist during and after Implementation	Communicate, Research	Co-develop / Co-create	Other *
Barki and Hartwick (1994a)							X			
Barki et al (2007)	X	X		X			X	X		X

[4] Coombs et al (2001) list best practices such as senior management commitment and participation, well balanced project team, user involvement, management of user expectations, user training, user support, and system testing.

	Requirements		Quality Assurance				Other			
	Provide functional requirements [#]	Define Forms, Screens, Reports and Queries	Prototype	Plan, Coordinate, Problem Solve	Risk Management	Test / Validate	Assist during and after Implementation	Communicate, Research	Co-develop / Co-create	Other [*]
Campbell, DeBeer, Barnard, Booysen, Truscott, Cain, Burton, Gyi and Hague (2007)			X	X		X				
Chakraborty et al (2010)	X									
Chen et al (2011)	X	X			X					
Coombs et al (2001)										X
Cowan, Gray and Larson (1992)				X	X					
Damodaran (1996)	X	X							X	
Dvir (2005)	X	X					X			
Fang (2008)	X	X							X	
Franz and Robey (1986)	X	X		X			X			X
Harris and Weistroffer (2009)	X	X					X			
Hsu et al (2008)	X	X				X				
Huang and Kappelman (1996)	X	X				X	X			
Iivari (2009)	X	X								
Ives and Olson (1984)	X	X							X	
Jiang, Chen and Klein (2002)	X			X						X
Kelly (2011)	X	X				X				
Kristensson et al (2008)			X						X	
McFarlan and McKenney (1983)					X					
McKeen and Guimaraes (1997)	X	X				X	X			
Millerand and Baker (2010)	X	X							X	
Ravichandran and Rai (2000)	X	X				X				
Robey and Markus (1984)	X		X	X						
Schummer et al (2006)								X		
Somers and Nelson (2004)				X	X			X		X
Sridhar, Nath and Malik (2009)				X						
Terry (2008)	X	X					X			
Wagner and Newell (2007)			X	X			X			
Wang et al (2006)				X				X		X
Zmud (1980)				X						

	Requirements		Quality Assurance				Other			
	Provide functional requirements #	Define Forms, Screens, Reports and Queries	Prototype	Plan, Coordinate, Problem Solve	Risk Management	Test / Validate	Assist during and after Implementation	Communicate, Research	Co-develop / Co-create	Other *
References: number of studies / frequency (%) of studies	19 / 61.3%	16 / 51.6%	4 / 12.9%	11 / 35.5%	4 / 12.9%	6 / 19.4%	9 / 29.0%	4 / 12.9%	5 / 16.1%	6 / 19.4%
	19 / 61.3%		19 / 61.3%				19 / 61.3%			

includes task complexity, process, calculations, data storage and security
* Budget, Train, Preproject Partnering

II.3.3 Selection of Users

Hsu et al (2013) suggest that since they find a positive relationship between user involvement and project outcomes, "managers should pay more attention to user representative selection" (p. 84). Rasmussen, Christensen, Fjeldsted and Hertzum (2011) focus on how to select users for participation. They argue that the team must have an understanding of groups of users with differing characteristics, and thereby posit three such groups: stakeholder groups (segmenting users by their use of the system), adopter categories (segmenting users by their propensity to adopt new technologies), and customer segments (various demographic and market segmentation criteria). Their empirical study suggests that selecting users based on a representative cross-section of the users may promote systems that satisfy the users' work requirements. It also suggests that weighting the user sample towards user advocates over a uniform statistical distribution may provide better results since advocates that can communicate minority positions will stimulate deeper requirements analysis. Finally, they note that user selection schemes that emphasize users with IT knowledge or experience may systematically bias outcomes that fail to satisfy users since the typical user views are underrepresented. Dean, Lee, Pendergast, Hickey and Nunamaker (1997) identify three layers of users: selected user representatives, the user group, and the entire user community. Gallivan and Keil (2003) warn that one must take care to manage vocal participants since they may not represent the more reserved members of the user participants.

Markus and Mao (2004) find that there are a large number of users whose roles and responsibilities vary within the organization. Selecting which users to be involved on a project may give preference to operational or managerial roles over other roles, or may be incomplete with respect to the number of participants. They suggest that successful solution development and implementation occurs when users are culled from a larger, rather than smaller, proportion of the affected stakeholder groups. In addition to the quantity of users, their numbers should include operational, management and relevant external stakeholders. Mursu et al (2007) argue that the aim of their Activity Driven Information System Development Model is participation of all stakeholders. Locke et al (1986) suggest that management must take care to select users with adequate knowledge of the subject matter and processes to mitigate the risks of low motivation and low product quality; Harris and Weistroffer (2009) support this finding. They also suggest that although active participation by appropriate users is generally beneficial, there are certain conditions where authoritarian decisions are preferred, such as when one person has significantly greater experience, there is a limited time for discussions, or the individuals prefer and are capable of working independently.

Although intuitive to practitioners, Amoako-Gyampah and White (1997) argue that user participants should have a vested interest in the project's success. They also suggest how to encourage effective participation including identifying participating users as early as possible, enabling direct user-developer communications, making the project team responsible for communicating status and schedule revisions, utilizing surveys and focus groups as a means of providing feedback, and establishing a climate of trust. Kristensson et al (2008) observe similar results but found them to be inconclusive. Kamadjeu et al (2005) find that users with vested interests, willingness to participate and some level of technical knowledge positively impact system implementation. Similarly, Saleem (1996) finds that functional experts with the ability to influence the system design significantly benefit both system quality and system acceptance. Kristensson et al (2008) propose this concept of engaging "lead users" as a research proposal. Therefore critical criteria for selecting users should include the user's functional expertise and if time and budget are tight, have them focus on the system's scope and resolving design and scope conflicts.

Cross-functional teams are seen as being critical to implementing global information systems (Biehl, 2007). The author notes the need for maintaining good cooperation and communication between these teams. Specifically, a large global complex system "demands the involvement of many people from many different functional and regional units, including the firm's supply chain partners, vendors, customers and consultants. Entrusting a project to the headquarters IT department is inadequate" (ibid, 2007, p. 58). This same study notes the impact of these factors on delivering a successful project. Further, their review of four unsuccessful projects found that earlier involvement of these cross-functional teams would have been beneficial to the final outcomes. This highlights the value of involvement by middle managers because of their drive for implementation as well as facilitating the education of the executive managers. Cavaye (1995) studied inter-organizational systems development efforts through case studies and generally found inconclusive evidence of a positive relationship between user participation and user satisfaction. However, this case study of customer-oriented systems finds that customer participation is related to systems developed with a strong external orientation.

Table 3 summarizes the studies of user selection for IS projects. Six of thirteen papers studied organizational breadth and seven of thirteen studied users considered to be Subject Matter Experts (SME), technical, or those with a vested interest in the project's success. Twelve of thirteen papers (92.3%) included organizational breadth, SME / Technical / Vested interest, or both.

Table III: Selection of Users

	Organizational Breadth		SME / Technical / Vested Interest	Weighted Representation	Other
	Multiple Group	Single Group			
Amoako-Gyampah and White (1997)			X		
Biehl (2007)	X				
Cavaye (1995)		X			
Dean et al (1997)		X			
Gallivan and Keil (2003)					X
Harris and Weistroffer (2009)			X		X
Kamadjeu et al (2005)			X		
Kristensson et al (2008)			X		
Locke et al (1986)			X		X
Markus and Mao (2004)	X				
Mursu et al (2007)	X				
Rasmussen et al (2011)	X		X	X	
Saleem (1996)			X		
References: number of studies / frequency (%) of studies	4 / 30.8%	2 / 15.4%	7 / 53.8%	1 / 7.7%	3 / 23.1%

II.4 Characteristics of Users Involved on Projects

II.4.1 Communication Methods of Users

Communication is important because of the need to share the user's vision of the final product so that the final product does not surprise the customer (Wiegers, 1997). Burns and Stalker (1961, pp. 121-122) define an "organic organization" as one that emphasizes coordinated response to changing demands characterized by lateral communications. Research of large software project teams has suggested that both formal and informal communication modes are equally influential to project success (Kraut and Streeter, 1995). Hyvari (2006) adds that communications is even more critical to success in large organizations. Faraj and Sproull (2000) suggest that user presence is insufficient; successful project results need specific communication processes that allow for interpersonal communication. Mahring (2002) characterizes IS projects as a communication paradox between two user groups. The first group is business management (portrayed as having limited task knowledge) working with the second group of IS management (portrayed as having limited domain knowledge); the solution requires that the two groups work together to address each other's bounded knowledge.

Howcroft and Wilson (2003) suggest that system developers are put into a tenuous position having to communicate their message using different languages or mediums to suit the targeted user group. Such miscommunication can be increased by "jargon-laden discussions and documents" (LaPlante, 1995, p. 3). Another communication issue discussed in the same article is that periodic status reporting is not always effective because the senior stakeholders may be preoccupied or distracted by the poor selection of language used during communication. The author points out that one possible solution might be to include a statement of what scope is being excluded from consideration. Leonard (2004) defines two relationship types: hard (requiring high communication frequency due to users being generally unable to help themselves) and soft (low communication frequency due to users being able to function independently from IT).

Brodbeck (2001) studied the methods and value of project communication between individuals and teams. The author researched the paradox that comes from an expectation of communication positively influencing project effectiveness and communication being seen as a non-productive activity that should be minimized to increase productivity. The article argues that internal communication related to specific activities does influence project success, the value of communication rises in the later stages of the project life cycle, and the use of standard tools and processes does not reduce the need for communications (ibid, pp. 87-89). Jiang et al (2000) contend that internal communications is not significantly related to team performance while external communications (top management and users) is significantly related to team performance. Koch and Turk (2011) argue that Agile[5] methodologies improve project communication. Amoako-Gyampah and White (1997) suggest that managing users

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[5] Agile is a modern lightweight project methodology developed in response to plan-driven bureaucratic methodologies. The Agile Manifesto (Highsmith, 2001a) defines the four sets of prioritized values of the Agile framework – individuals and interactions over processes and tools, working software over comprehensive documentation, customer collaboration over contract negotiation, and responding to change over following a plan. Agile emphasizes user satisfaction as a result of their active participation in adaptive processes. Hoda et al (2011) considers customer collaboration to be a vital feature of Agile software development.

involves two forms of bi-directional communication: the project teams must communicate between themselves and the project teams must communicate with the user groups. This project-user group communication should be motivated through supportive messages. Grover, Henry and Thatcher (2007, p. 81) find that non-integrated communication between users and IT management "does not bode well, considering that IT assets are a collective resource that leverages the business." They argue for increased accountability of top management to help in the relationship between business and IT management; this frequently is obtained through steering committees that can cross the functional boundaries.

Table 4 summarizes the available papers concerning user communications in IS projects. Six of thirteen identify communication in various forms as a critical success factor for project success (such as risk management, delivery of requirements, and responding to changing factors) while seven of thirteen propose specific processes for good communication (such as internal / external and formal / informal). Two papers noted the need to acknowledge and address differences in language or jargon between various groups of people on the project, noting that the translation time and potential for misunderstanding can lead to significant errors and delays.

Table IV: User Communication

	Critical Success Factor	Specific Processes	Multiple Jargons
Amoako-Gyampah and White (1997)		X	
Brodbeck (2001)		X	
Burns and Stalker (1961)	X		
Faraj and Sproull (2000)		X	

	Critical Success Factor	Specific Processes	Multiple Jargons
Grover et al (2007)		X	
Howcroft and Wilson (2003)			X
Hyvari (2006)	X		
Jiang et al (2000)	X		
Kraut and Streeter (1995)	X	X	
LaPlante (1995)		X	X
Leonard (2004)		X	
Mahring (2002)	X		
Wiegers (1997)	X		
References: number of studies / frequency (%) of studies	6 / 46.2%	7 / 53.8%	2 / 15.4%

II.4.2 Timing of User Involvement

Numerous studies indicate that user involvement is greatest when limited to specific phases. Ives and Olson (1984) find that methodologies frequently prescribe user involvement during the initial phase when the requirements and design activities are being performed with additional involvement being recommended during the implementation phase. Terry (2008) also notes the preference to involve users during the earliest phases of a project (typically requirements gathering). Wagner and Newell's (2007) study of large enterprise systems such as Enterprise Resource Planning (ERP) and Customer Relationship Management (CRM) find that there is a post-implementation phase that benefits from user participation describing such participation "as a normal and necessary part of systems development" (ibid, p. 509). Research on ERP and CRM system implementations suggests that the post-implementation involvement may even be more significant than pre-implementation participation (Wagner & Piccoli, 2007). They argue that this behavior is to be expected since during the pre-implementation period, the users' focus is on their primary job responsibilities while during post-implementation, the users have now been immersed in the new system where the new system is impacting their work environment.

Franz and Robey (1986) further clarify user involvement along temporal lines by studying participation during various phases of the system development life cycle. They find two phases of the life cycle where UI was most impactful: planning and design, and implementation. These early studies were unable to find significant consistent relationships between user involvement and project success, pointing to inconsistent methodologies and construct definitions. LePage (2009) confirms the need for early involvement in his article on IS projects in the electric utility market.

Gemino et al (2008) state in their temporal study that user participation is one of the *a priori* risk factors that could affect project performance. They did not find any significant relationship between organizational support (which included UP) and project product performance. Song, Thieme and Xie (1998) study temporal factors in new product development projects and find that participation by different user groups has varying levels of influence by project phase. They note that the type of joint involvement (i.e., the various pairs of user teams), the nature of relationships between teams and the strength of the joint involvement all affect project success. Jiang et al (2002) show that user and systems staff agreeing on system objectives prior to the start of the project is important, but the two groups may not have actually come to an agreement due to ambiguous definitions and assumptions. This is supported by psychological studies of "goal congruence" (Vancouver & Schmitt, 1991) and by the Theory of Reasoned Action (Fishbein, 1980) where beliefs, attitudes and intentions are antecedents to behaviors.

Dvir (2005) finds that user preparation for implementation is an important factor in overall project success.

Filippini, Salmaso and Tessarolo (2004) find that early user involvement will positively impact the time performance of new product development projects when combined with a new product strategy guide and high level capabilities. Early involvement is related to the concept of user readiness (Sheu & Kim, 2009) as demonstrated through users having a realistic expectation of project results (Coombs et al, 2001). Finally, Larson (1997) identifies a number of project partnering activities that when performed early in the project life cycle positively impacts construction project success.

Locke et al (1986) model an employee's participation based on their degree of job experience and suggest a three stage model of participation. In stage 1, the employee has little experience and would therefore contribute ideas with limited value. In stage 2, the employee works collaboratively with management to contribute to the project. In stage 3, the employee is delegated decision making authority. Therefore, only stage 2 is appropriate for participative (joint) decision making activities.

Coombs et al (2001, p. 6) defines user ownership as "the state in which members of the user community display through their behavior, an active responsibility for an information system". They note that it often is not possible for user ownership to be displayed in all phases of a project and users may not be the only "owners" of the system under development. Their case study indicates the importance of user ownership to project success.

There is contradictory research indicating that some aspects of user involvement should exist in all phases of the development life cycle. For example, Hsu et al (2008) find that users should not only provide the requirements as the project begins, but they should continue to act throughout the project as gate keepers to reduce uncertainty. Fortune and White's (2006) study of a successful project find that users are involved through the entire project although to varying degrees. There is evidence suggesting that users allowed to have considerable participation in one phase of a project do not need to have such participation in additional phases of the project to support user satisfaction with the overall project (Wu and Marakas, 2006). Millerand and Baker (2010) propose a model that is design-centric, that is the design / redesign activities happen continuously in all phases of a project. De Moor et al (2010) suggest that mobile computing technology projects benefit from continuous user involvement. Dvir, Raz and Shenhar (2003) note that user involvement adds value throughout the entire project life cycle, especially the definition of goals and functional and technical specifications. Hoda et al (2011) state that the customer's role exists throughout the entire development process. Kristensson et al (2008) find that the co-creator role should be active throughout the entire project life cycle. Yetton, Martin, Sharma and Johnston (2000) argue that user involvement in all stages of project development increases the chance of project completion. They go on to speculate that the integration of both senior management and end user activities in all stages of a project provides continuity that contributes to quality and acceptance of the system. Similarly, Mahanti (2006) proposes that key stakeholders should remain engaged throughout the entire Agile lifecycle.

There may even be reason to promote user cooperation prior to the start of a project. Such “preproject partnering” reduces the risk of low user support and positively impacts project performance (Jiang et al, 2002, p. 21, Figure 1; Cowan et al, 1992). The authors view many of the user activities as a response to low or missing user participation. This preproject partnering must be monitored since expectations between users and developers often did not match. Kristensson et al (2008) argue for earlier customer involvement in both reactive and proactive forms.

Table 5 summarizes the 22 papers surveyed that address the timing of user involvement. For this analysis, we did take a different approach to the creation of the summary table than in other portions of this research. There is a general acceptance of IS projects requiring planning and design to precede the construction of the solution (software and infrastructure) which is then followed by the deployment of the solution; therefore the initial table included these three columns. The analysis of the literature added two additional columns – one for user involvement prior to the project start and another for those studies that considered a user being continuously involvement through all project phases. Half of the papers indicate the significance of continuous user involvement in IS projects; one of those (Kristensson et al, 2008) argue for user involvement prior to the start of IS projects. Seven papers (31.8%) found evidence for user involvement focused during specific phases of an IS project, specifically the initial planning and design, or the deployment and post-deployment phases. It is interesting to note that none of the papers surveys found evidence for selected user involvement during the construction phase of an IS project. The construction phase of IS projects is where the actual solution is built for the users, yet Table 5 highlights that there were no studies that explicitly researched user involvement during that phase. The eleven papers that promote continuous user involvement throughout a project imply that there would be UI during the construction phase, but this is an implication that was not explicitly found in the literature.

Table V: Timing of User Involvement

	Prior to Project Start	Selected Project Phases			Continuous Involvement
		Planning and Design	Construction	Deploy and Post-Implementation	
Cowan et al (1992)	X				
De Moor et al (2010)					X
Dvir et al (2003)					X
Filippini et al (2004)		X			
Fortune and White (2006)					X
Franz and Robey (1986)		X		X	
Gemino et al (2008)	X				
Hoda et al (2011)					X
Hsu et al (2008)					X
Ives and Olson (1984)		X		X	
Jiang et al (2002)	X				
Kristensson et al (2008)	X				X
Larson (1997)	X				
LePage (2009)		X			
Mahanti (2006)					X
Millerand and Baker (2010)					X
Song et al (1998)					X
Terry (2008)		X			
Wagner and Newell (2007)				X	
Wagner and Piccoli (2007)				X	
Wu and Marakas (2006)					X
Yetton et al (2000)					X
References: number of studies / frequency (%) of studies	5 / 22.7%	5 / 22.7%	0 / 0.0%	4 / 18.2%	11 / 50.0%

II.4.3 Levels of User Involvement

Some roles do not require full time participation or commitment and yet are considered to be significant with regards to their impact on the project outcome. One part-time user role often cited in critical success factor research is the role of the senior executive. Liu et al's (2010) study of IT project risk document that senior executives focus on different (higher) levels of project risks than IT project managers. Senior management's monitoring of a new product development project can be a motivating factor for the team to spur them towards innovation (Sethi, Smith and Park, 2001). Studies across multiple industries also indicate the significance of senior management involvement (Whittaker, 1999). The executives must assume a posture of patience with project delays as developers under time pressures may lower the quality of their output in various ways (Jaikumar, 2001). Another part-time role is that of a change management coordinator (Motwani, Mirchandani, Madan and Gunasekaran, 2002) typically associated with large IT projects[6].

The relative level of participation between the users and the development team has been proposed as being relevant. Mumford (1983) suggests three levels of participation: consultative (occasional user interviews), representative (user participating in detailed design sessions and decision making), and consensus (involving all users in all processes and decisions). Saleem (1996) observes that standard information systems may have satisfactory user participation at a lower level than when the design team has limited

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[6] Motwani et al (2002, p. 86) define change management as the activities necessary to balance forces in favor of change over forces of resistance.

domain knowledge or when the uncertainty (i.e., risk) is high. Damodaran (1996, p. 365) states that “it is not sufficient just to have participation; what is needed is effective participation. The users should be able to influence design, not merely ‘rubber stamp’ it.” It has been suggested that even if the level of participation has been deemed to be sufficient, the method of communication was ineffective and therefore contributed to a reduced level of system acceptance (Gallivan & Keil, 2003). This suggests that the level of participation may not be a useful tool to determine the effectiveness of user participation (Guinan and Faraj, 1998). Harris and Weistroffer (2009, p. 752) argue that UI “has the greatest impact on system success if the user is allowed to voice an opinion and make choices from predefined options.” They also suggest that there is an optimal level of user involvement indicating that either too much or too little involvement may be counterproductive.

Although most research has been performed in Western cultures, Geethalakshmi and Shanmugam (2008) study Indian internal software development practices. They find that the level of customer and user involvement contributes more to project success than software process management and estimation and scheduling, and further suggest that this involvement should occur in all phases of a project.

Philip, Afolabi, Adeniran and Oluwatolani (2010, p. 984) suggest that “project members must intensively interact with users … to improve the chance that the final system will be adopted by users”. The authors propose three representations of participation based on the user type: project managers, actors such as analysts and developers, and end users. Fuller, Valacich and George (2008, p. 12) state that relatively high levels of user involvement are needed for project success along with the management of their expectations. However, Subramanyam, Weisstein and Krishnan (2010) state that the overall level of participation must be controlled since participation perceived to be too large can reduce overall project success.

Agile methods[7] frequently involve a "daily standup meeting" where all team participants, including customers, are physically or virtually present (Hoda et al, 2011). The purpose is to maximize full team communication while limiting each person's time to communicate. One method of increasing user participation is to co-locate them with the design and development team. Wake (2000) notes that the users' physical presence allows for immediate communication, full exploration of issues and options, and a visible understanding of progress. Wake (2009) documents a "lessons learned" session where the marketing manager thought highly of being co-located. Tom Peters (addressing critical success factors for project managers) puts the value of user immersion more bluntly: "Make clients an integral part of every project team" (Peters, 1999, p. 105) and "If the client won't give you full-time, top-flight members, beg off the project. The client isn't serious." (ibid, p. 106). Hoda et al (2011) identifies a number of causes that tended to reduce customer involvement in IS projects using Agile methods; these were skepticism and hype (caused by a lack of familiarity with Agile methods), distance factor (the physical distance between the majority of customers and the technical teams), lack of sufficient time commitment, dealing with large customers (these customer types are often

[7] See the opening of Section III.1.4 for an overview of Agile methods

more familiar with traditional waterfall[8] methods and resistant to change), fixed-bid contracts (contractually fixing time, cost and scope runs counter to the Agile Manifesto's tenant of valuing "customer collaboration over contract negotiations"), and ineffective customer representative (those who do not understand the implication of the system being addressed or lacking in Agile practice awareness). As a result, Agile teams feel pressure to over-commit, experience problems in gathering, clarifying and prioritizing requirements, have problems securing feedback, and experience a loss of productivity that sometimes progress to the point of losing business (ibid, p. 525-528).

Flexible manufacturing systems are one example of involving significant design effort from multiple skill sets. Having a goal of unattended operations leads to much larger amounts of time and analysis during design (i.e., early in the project life cycle) because users are able to anticipate many possible contingencies which may otherwise be overlooked (Jaikumar, 2001, p. 72)

Table 6 summarizes the eighteen papers researching the level of user involvement in IS projects. Approximately thirty nine percent of studies researched the impact of high levels of user involvement while eleven studies researched low or moderate levels of impact.

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[8] Hong, Thong, Chasalow and Dhillon (2011, p. 236) identify user involvement within the waterfall methodology as requiring the accurate description of all requirements of their needs at the beginning of a project.

Table VI: Levels of User Involvement

	Low Levels	Moderate Levels	Impact of Culture	High Levels
Damodaran (1996)		X		
Fuller et al (2008)				X
Gallivan and Keil (2003)		X		
Geethalakshmi and Shanmugam (2008)			X	
Guinan and Faraj (1998)		X		
Harris and Weistroffer (2009)		X		
Hoda et al (2011)				X
Jaikumar (2001)	X			X
Liu et al (2010)	X			
Motwani et al (2002)	X			
Mumford (1983)		X		
Peters (1999)				X
Philip et al (2010)				X
Saleem (1996)		X		
Sethi et al (2001)	X			
Subramanyam et al (2010)				X
Wake (2000)				X
Whittaker (1999)	X			
References: number of studies / frequency (%) of studies	5 / 27.8%	6 / 33.3%	1 / 5.6%	7 / 38.9%

II.4.4 User Effectiveness

Although methodologies have evolved and interest in user participation plays a significant role in many methodologies, the best method for integrating user involvement into system development is not always evident (Iivari et al, 2010; Iivari, 2009). This may be due to viewing them as inconsequential users of a technology and not actors in an organizational setting (Iivari, 2009; Leonard, 2004). Amoako-Gyampah and White (1997) argue that user involvement must be managed deliberately since membership alone or simple review and approval activities are insufficient. Hartwick and Barki's (1994) research on whether a user's participation was volunteered or mandated supports the idea that user participation and involvement are factors that can predict voluntary use, but the same user participation and involvement are not factors affecting systems requiring mandatory use. In organizations that suppress effective user involvement, users may feel as if they are either in a "hostage" role (active involvement is blocked by the analysts and designers) or a "propagandist" role (user are subjected to training in design methodologies and tools) (Damodaran, 1996, p. 365).

Recent information system development methodologies attempt to address the need for more effective user involvement; these methods include techniques such as Joint Application Development (JAD), Rapid Application Development (RAD), Information Engineering (IE), Scrum[9], and others. Garrety, Robertson and Badham (2004) study technology development projects and suggest an approach that identifies "communities of practice" for the purpose of improving the balance between differentiation and integration. Cowan et al (1992) find that "preproject partnering" may be a significant precondition to effective user involvement. Although these approaches have shown some improvement along different dimensions, none has been able to claim consistent results across multiple environments and scenarios. According to Yourdon (1993), "there is no one silver bullet, but there are a dozen or so that are worth exploring".

National cultural differences can affect amount of perceived risk existing in a project. For example, Peterson and Kim (2003) studied IS designers from Japan, Korea and the Unites States to find that cultural issues based on country are a significant factor

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[9] Scrum is an instance of the Agile Framework. It is a lightweight, iterative IS development methodology designed to productively address complex adaptive problems (Schwaber and Sutherland, 2011).

in the perception of project risk. Canel, Mathieu and Das (1997) find other inhibitors to project success as a result of user involvement including the difficulty creating specifications that users can understand, scheduling delays when involving multiple user groups, and the potential for sub-optimal solutions due to differing priorities between user groups. That same paper notes a possible long term benefit of user involvement being decreased dependency on the IT department.

The motivation of firms to encourage user participation can come from a number of sources. Fishbein (1980) argues for a generalized theory of motivation where one's behavioral beliefs affect their attitude towards the behavior, normative beliefs affect their subjective attitudes, and both attitude types in turn affect intentions that motivate behaviors. This Theory of Reasoned Action is cited by Doll and Torkzadeh (1988) in their study of perceived value of end user satisfaction. Clement and Van den Besselaar (1993, p. 34) study motivational factors including end users being better qualified to identify their actual requirements, end user perceptions about their technology tools are as important as the tools themselves, and technology needing to be adapted to the workplace where it will be utilized. There is an economic argument for user participation on projects to provide a competitive advantage by leveraging a highly trained workforce. Montazemi, Cameron and Gupta (1996) find that there is no difference between user and information center product specialists regarding the perceived ease of use of end user software packages; they also find that the actual usefulness of selected packages is lower than the information center product specialists. This finding suggests that end users should be encouraged to have a stronger voice in product selection.

Kristensson et al (2008) posit seven Research Propositions (RP) on strategies for improved user involvement based on their single case study exploratory research:

RP1: Derivation from user situation (embedding the user into a real-life situation allows them to consider potential solutions to the newly discovered problem or opportunity)

RP2: Derivation from various roles (ensuring that participants experience a variety of use situations to have them experience the product in use)

RP3: Analytical tools (providing participants with present and future related technologies)

RP4: Apparent benefits (benefits noted by users will tend to be those which provide them direct benefits, as opposed to general public benefits that they may not encounter)

RP5: Non-use of brainstorming (experiencing a prototype provides better ideas than "undifferentiated and directionless brain-storming activities")

RP6: Limited expertise (they find no evidence supporting the need for active users to have expertise in the technology; in fact they note that such expertise may generate predictable thinking)

RP7: Ensuring heterogeneity (since the development team tends to be homogeneous, the need for a heterogeneous user community is greater)

Table 7 summarizes the fifteen papers investigating user effectiveness on IS projects. The greatest numbers of studies focus on the motivation of the employee. Five studies investigate the perception of the user role. The remaining three papers study the project methodology used during the user involvement.

Table VII: User Effectiveness

	Perception	Methodology	Motivation
Amoako-Gyampah and White (1997)	X		
Clement and Van den Besselaar (1993)			X
Cowan et al (1992)		X	
Damodaran (1996)	X		
Doll and Torkzadeh (1988)			X
Fishbein (1980)			X
Garrety et al (2004)		X	
Hartwick and Barki (1994)			X
Iivari et al (2010)	X		
Iivari (2009)	X		
Kristensson et al (2008)			X
Leonard (2004)	X		
Montazemi et al (1996)			X
Olsson (2008)			X
Yourdon (1993)		X	
References: number of studies / frequency (%) of studies	5 / 33.3%	3 / 20.0%	7 / 46.7%%

II.5 User Participation through the Project Life Cycle

Heinbokel et al (1996) argue that usable software can only be developed with user involvement. However, there are two differing findings in the research regarding the timing of when users should participate throughout the project life cycle. Sashkin (1984) proposes three types of contingencies when considering participation as an ethical imperative[10]: psychological (values, attitudes and expectations of organizational members), organizational (a measure of the interdependency of team members), and environmental (technology, regulations and competition). There is also a variety of thought regarding the amount of participation based on one's role and activities.

II.5.1 User Participation by Phase

User availability to participate on IS development projects is often limited due to their other job responsibilities. Damodaran (1996) suggests that effective participation is of greater value than just participation in general. Subramanyam et al (2010) suggest that user participation at excessive levels can reduce overall project success. Wagner and Newell (2007) argue that large information system implementations may benefit more from post-implementation involvement due to the user's change in focus caused by their other responsibilities. Franz and Robey's (1986) temporal study strongly support varying activities by project phase. The construction phase of IS projects is where the actual solution is built for the users, yet Table 5 highlights that there were no studies that explicitly researched user involvement during that phase. Typically users are never involved with the actual construction tasks of designing architecture, writing code or performing unit testing due to their highly technical nature; therefore this finding is intuitively obvious. The ten papers that promote continuous user involvement throughout

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[10] Sashkin (1984) argues for participative management based on it not causing any harm to people while simultaneously satisfying "three basic human work needs: autonomy or control over one's own behavior; completion or achievement of a whole, finished task; and interpersonal contact in the context of work activities" (p 10). The article then defines this argument as being an ethical imperative for management.

a project imply that there would be UI during the construction phase, but this is an implication that was not explicitly found in the literature.

II.5.2 User Participation through all Phases

Agile methodologies strongly emphasize user involvement and participation across all phases of a project. Wake (2000) cites how various implementation methodologies recommend that users co-locate with the IS development team to maximize communication between these groups throughout the full project life cycle. Recent studies, such as Hsu et al (2008), Fortune and White (2006), Hoda et al (2011) and De Moor et al (2010), all find that continuous user participation benefits project performance. The concept of "pre-partnering" has also been shown to lower project risks and positively impact project performance (Cowan et al, 1992; Jiang et al, 2002).

II.5.3 Levels of User Participation

Not all roles require full-time participation. Noteworthy among them is the role of senior executive. Liu et al (2010) suggests that their impact is significant, but their actual time allocated to a project may be relatively small with respect to the overall project. Based on Saleem (1996), the amount of overall participation may vary by the type of IS product being developed – standard IS functionality may need less participation than when the final product's uncertainty or risk is high. Geethalakshmi and Shanmugam (2008) find that culture influences the need for varying levels of customer participation.

II.5.4 Team Communication

Users are the customers of the IS product or service to be delivered; they are in the unique position to be able to understand their requirements. The IS team that will design, build, test and deploy the product or service will not, typically, use the project's deliverables and therefore do not necessarily fully understand the needs, opportunities or nuances facing the users. A primary function of communication between users and the IS team is this transmission of requirements. This communication may be presented as formal or informal (Kraut and Streeter, 1995), hard or soft (Leonard, 2004) or internal and external (Jiang et al, 2000). There is also a barrier caused by technical jargon used within the IS team that must be traversed. Therefore, the frequency, modes, level and methods of communication must be planned and well executed to support project success. Finally, quality communication practices may have varying levels of impact on project success depending on project phase.

II.6 Moderating and Mediating Variables

User involvement and user participation are frequently modeled as direct independent variables impacting project success. Research shows that there are other direct and indirect variables as well. This section highlights these moderating and mediating variables documented in prior research.

II.6.1 User Satisfaction

"Project success" and "user satisfaction" are terms that have often been considered synonymously. For example, a meta-analysis by Harris and Weistroffer (2009, pp. 751-752) finds support for user involvement positively impacting user satisfaction which they argue is a proxy for system success. Further, Nidudolu and Subramani (2004) include a "performance criteria" construct that includes budgets, schedule and software functionality as their proxy for user satisfaction in their study of approaches to managing software development projects.

DeLone and McLean (1992) find that there is no direct measure for the success of an information system project. They then argue for the use of user satisfaction as being "especially appropriate when a specific information system was involved" (ibid, p. 68). Terry (2008, pp. 199-200) describes user satisfaction for business-to-consumer systems as being related to meeting requirements and usability. Ives et al (1983, pp. 785-786) provide a thorough description of the user satisfaction construct. They note that it is a "perceptual or subjective measure" that although in theory is defined by economics, the practical effect cannot be so easily measured. They create an instrument with 39 measures for user satisfaction as well as a "short form" instrument with only 13 measures. This instrument was later confirmed by Baroudi and Orlikowski (1988). User satisfaction has been used as the dependent variable in empirical research models as a surrogate of project success and user involvement (Hsu et al, 2008; Doll and Torkzadeh, 1989; McKeen et al (1994), McKeen and Guimaraes, 1997; Ives et al, 1983). Specifically, Hsu et al (2008) notes that 18 of the 31 articles they reviewed employed "user satisfaction" as their dependent variable with various types of user participation as independent variables. Their analysis shows 15 studies indicating positive effects of participation, two indicating insignificant effects and one showing negative effects. Chen et al (2011) studies six factors related to project management performance comprising meeting project goals, completing the expected amount of work, achieving high quality, adherence to schedule, adherence to budget, and efficient task operations.

Pinto and Slevin (1988) note that project success can only be properly defined when it includes measurements of user satisfaction and the product's use and effectiveness. Sridhar et al (2009, pp. 94-95) found that user involvement positively impacts their behaviors and activities, and that these behaviors and activities positively impact the perceived quality of IS projects and the effectiveness of the teams. McKeen et al (1994) study four factors: task complexity, system complexity, user influence and user-development communication. A set of potential moderators might include the motivating factors behind UI in the organization. Mumford (1983) lists a number of such motivating factors: avoidance of problems, becoming an ethically responsible organization, increasing trade union member status and power, and reducing the stress between management and labor. A review of McKeen and Guimaraes (1997) and Ives and Olson (1984) provides the following list of possible moderating factors: system complexity, stage of development, desired versus actual level of participation, semantic gap, mediation, task and decision environment, degree of influence, communication, degree of involvement, user attitude, respect, risk, power and influence, top management support, degree of programming in the system environment, type of involvement and organizational characteristics and MIS department characteristics. Other studies have noted the significance of the users' overall responsibility on their participation (Barki and Hartwick, 1989; Hartwick and Barki, 1989). Locke et al (1986) suggest that cognitive benefits may be one of the primary values of user participation. Lawrence and Low (1993) found significant correlation between user involvement ("user representativeness") and user information satisfaction (a frequent proxy for project success). Baroudi, Olson and Ives (1986) study two models of user involvement on IS projects. Model I supports systems usage as a mediating factor between user involvement and user information satisfaction. Model II supports user information satisfaction as a moderating factor for user involvement on system usage.

Wang et al (2006) specifically study the effect of management controls on IS project performance where "management controls" are defined as "the activities which encourage employees to behave in accordance with organizational goals" (ibid, p. 214). They find that both management controls and user-IS personnel interaction positively impact project performance, and active management controls also positively influence the user-IS personnel interactions. They argue that the quality of the user-IS personnel interaction may be a better predictor of project performance than the extent of user participation activities.

Markus and Mao (2004), in an updated information system participation theory, identify four participation activities that can influence project success: type (solution development, solution implementation and project management), richness (larger quantities of time from users, change agents for users constrained from significant time commitments and deeper knowledge of potential users' requirements), methods (the use of non-technical analysis techniques, acquiring both socio-technical and functional requirements, using facilitated sessions), and conditions (full-time employees when possible, sessions held near users' facilities, and securing adequate schedule and budget resources for user participation). Soja (2006), in a study of 26 ERP success factors, identifies two factors related to the participants (team composition and team involvement) as being significant across the dimensions of enterprise size, scope and time. Aladwani (2002) notes that project performance is a multidimensional construct; therefore it is reasonable to expect benefits that can be characterized in multiple dimensions.

II.6.2 User Participation

Howcroft and Wilson (2003) outline five paradoxes that impede effective participation: the rhetoric of empowerment, the rhetoric of involvement, the exclusion of dissent, the illusion of compatibility and the outcome of participation. Information system development methodologies may themselves inhibit user participation (e.g., Beath and Orlikowski, 1994 describe a deconstruction of *Information Engineering* performed to identify internal contradictions). Markus and Mao (2004) identify a difference in involving users and the development methods. Many methodologies will note user participation during various activities or during selected phases of work, but exclude specifics on how the participation should occur. Sashkin (1984) suggests that user participation is an ethical imperative; however Locke et al (1986) reject this suggestion due to their finding that job satisfaction is a joint responsibility between employee and employer.

II.6.3 Conflicts

Information system development can be considered a form of organizational change. As such, a social change model from the study of organizational behavior can be applied as it generally includes the idea of "constructive change" (Robey and Farrow, 1982; Robey, Farrow and Franz, 1989; Barki and Hartwick, 1994b). The benefit of such a model is that it addresses the situation where multiple success criteria exist and stakeholders have incompatible goals; i.e., conflict can result in either productive or destructive outcomes. Robey and Farrow (1982) suggest that higher levels of influence on conflict found during the initial phases of a project can be attributed to the polite nature of a less structured environment. The later phases of a project indicate that influence positively impacts conflict resolution as the team members learn to use their influence for the benefit of the project (ibid, p. 82). Group meetings also provide a means to resolve conflicts (Robey et al, 1989). This later study used more reliable measures, collected data at multiple points throughout the project life cycle and identified a more parsimonious model while supporting the same findings. Jiang and Klein (2000) find that elevated conflict levels decrease the quality of work. Olsson (2008) notes the conflicting demands of internal project flexibility (seeking to maximize project efficiency) and external project flexibility (seeking to align the project with changing business strategy).

Robey et al (1993) investigate user participation, influence, conflict and conflict resolution to determine their relative influence on project success. Although UP has moderate positive influence on project success, conflict resolution has a notably larger positive impact on project success. Projects experience a number of conflicts relating to users being involved in information system projects. One earlier article (McFarlan and McKenney, 1983) identifies how users tend towards addressing short term needs over longer term development activities. Competing with that is the IS department's tendency to master one or more particular technologies as opposed to quickly addressing user needs. Subramanyam et al (2010) note that these potentially conflicting priorities between users (an emphasis on schedule and budget) and developers (emphasizing achievement and excellence) can introduce stress to the project. Barki and Hartwick (1994b) advance this model by separating "conflict" into two components: "conflict" (indicated by intergroup and interpersonal friction, poor communication, an increase in rules, escalation of issues, and low morale, p. 424) and "disagreement" (a "divergence of opinions and goals", p. 428).

Wang, Chen, Jiang and Klein (2005) study a refined model of conflict within a project by separating user-IS conflict from conflict among project team members. Their findings support that a reduction in user-IS conflict can motivate improved project success. They also find that even when user-IS conflict cannot be reduced, the overall project success can be improved by reducing conflict between project team members.

II.6.4 Comprehensive Model

Empirical research is often constrained by the number of questions that can be practically answered before the respondent abandons the survey. This limits the size of the research model being studied. However, many of the empirical studies in the literature have few constructs. Doll and Torkzadeh (1988) call for studies involving type of application. McKeen and Guimaraes (1997) call for an expanded model to include additional measures of user participation (specific activities). Millerand and Baker (2010) propose interdisciplinary research across information systems and social science perspectives. Finally Chen et al (2011) state that further decomposition of selected constructs will improve understanding.

The literature also calls for the use of multiple measures of user satisfaction. There have been findings of project success being defined without clarity (Robey, et al, 1993, p. 137). Harris and Weistroffer's (2009) meta-analysis states that user satisfaction is a proxy for system success. Traditional concepts of project performance have focused on the "triple constraint" of budget, schedule and scope. Finally, studies recommend the use of larger sample sizes with focused sample sets while addressing the generality of the research as measured by surveying multiple industries, and a variety of company sizes and geographies.

II.7 Research Methodologies used by selected papers

This section analyzes the available research by model type providing an understanding of how prevalent various research techniques have been employed.

II.7.1 Research Models

Ives et al (1983) performed an empirical study to identify factors critical to user information satisfaction. A number of the factors in their larger questionnaire are related to user involvement and participation. Ives and Olson (1984) find that much of the early research on UI was flawed and generated non-supportive or contradictory results due to poor theory, measurements, methodologies or controls. They leverage Participatory Design concepts to propose a framework for UI positively impacting IS project success. Based on this previous work, Barki and Hartwick (1989) propose a significant improvement of the UI construct by dividing it into two primary components: user involvement and user participation. This separation of system relevance from user behaviors (UI and UP respectively) is supported by research from psychology and organizational behavior.

Early research found non-supportive and contradictory findings regarding user involvement's impact on IS project success. There have since been a large number of empirical studies that continue to find UI and UP generating positive impact on IS project performance. The nine articles documenting insignificant or contradictory results are all related to other factors besides UI and UP directly. For example, Ewusi-Mensah and

Przasnyski (1991) show that projects with active UP can still be abandoned, and Rasmussen et al (2011) find that user selection schemes emphasizing users with IT knowledge or experience may systematically bias outcomes that fail to satisfy users since the typical user views are underrepresented.

II.7.2 Theory Building

Theory Building articles review previous research or other publications to derive insights or new theories regarding UI on project success. Table 8 lists the 42 papers that develop theory related to user involvement. The list is grouped by the subject area studied as part of the theory development effort by the respective authors. Table 9 further summarizes these papers by subject area and the time period that it was published. As Table 9 indicates, 28 of the 42 studies have been performed with the last twelve years. Across all categories, no single category represents more than 22% of the studies.

Table VIII: Analysis of Theory Building Studies

Subject Area	Articles	Finding
UI and UP constructs	Barki and Hartwick (1989)	User Involvement is separate from User Participation
	Ives and Olson (1984)	Much early work is flawed due to poor theory, measurement and methodologies
Methods and Techniques	Beath and Orlikowski (1994)	Methods can have internal contradictions with respect to user involvement
	Beynon-Davies and Holmes (2002)	Scenarios and Design Breakdowns are useful techniques for gathering IS requirements
	Beynon-Davies, Mackay and Tudhope (2000)	RAD supports increased user involvement
	Gulliksen, Goransson, Boivie and Blomkvist (2003)	Four principles (user focus, active user involvement, usability champion and a user-centered attitude) impact IS success
	He and King (2008)	Meta-analysis found that UP may only be minimally-to-moderately beneficial to IS projects
	Nelson (2007)	Agile methodologies are recommended if the requirements have not been well defined or significant user involvement is needed

Subject Area	Articles	Finding
	Wagner and Newell (2007)	Prototypes create a "feedback loop" which enables the analysis and design phases to be performed synchronously by the designers, builders and users
Timing and Level of UI	Campbell et al (2007)	UI beneficial during product verification; customers often limited to start and end of projects
	Fortune and White (2006)	Users on successful projects are involved through the entire project although to varying degrees
	Lettl (2007)	Effective UI can vary by phase
	Mahanti (2006)	Stakeholders should remain engaged throughout the Agile lifecycle
	Mumford (1983)	Three levels of participation are proposed: consultative, representative, and consensus
		A number of moderating factors are proposed
Project Success	Cowan et al (1992)	Partnering impacts project performance and partnering is a possible antecedent to effective UI
	Havelka and Rajkumar (2006)	A lack of UI contributes toward troubled projects
	Kamadjeu et al (2005)	Users with vested interests, willingness to participate and some level of technical knowledge positively impact system implementation
	Ngai et al (2008)	Top management is considered as one of 18 critical success factors when adopting ERP systems
	Petter (2008)	User's expectations of project outcomes are a significant factor in the user's satisfaction with the outcomes
	Sheu and Kim (2009)	User readiness correlates to IS project success, but may be moderated by the project complexity
	Slevin and Pinto (1987)	Ten critical success factors for project success
	Upton and Staats (2008)	CEO-level involvement is important on strategic IT projects
Participatory Design	Bjerknes (1993)	Specify level of user time commitment; ensure management support
	Buhl and Richter (2004)	Communication methods reduce stress and improve quality
	Cahill and McDonald (2006)	Prototypes impact product success
	Clement and Van den Besselaar (1993)	UI leads to better identification of requirements and ability to adopt technology to the workplace
	Schummer et al (2006)	Designers would still perform the major design activities but emphasize communication with users throughout the entire process
IS Project	Amoako-Gyampah and White (1997)	Structural integration is insufficient; UI must be managed to be effective
	Biffl et al (2006)	Loosely engaged executives may need extra effort to become active participants

Subject Area	Articles	Finding
	Coombs et al (2001)	User ownership related to project success; use of best practice methods impacts user attitude
	Dean et al (1997)	Three layers of user involvement
	De Moor et al (2010)	Continuous user interaction is needed
	Keil and Robey (1999)	Six roles help trigger de-escalation of a project's priority
Other	Ariyachandra and Frolick (2008)	Business Performance Management: Users need specific assignments and roles
	Canel et al (1997)	Multiple user groups can cause schedule delays and sub-optimal solutions
	Cavaye (1995)	UP is related to systems with strong external orientation
	Gallivan and Keil (2003)	Identifies four stages of communication for effective requirements gathering and prioritization
	Garrety et al (2004)	Improving communication between "communities of practice" and project teams positively impacts both
	Iivari (2009)	Some users are non-technical and disinterested – only interested in the resulting solution
		UP can be informative, consultative or participative
	Kristensson et al (2008)	The role of co-creator is significant. They also find inconclusive support for various user communication techniques
	Liu et al (2010)	Senior executives focus on different (higher) levels of project risks than IT project managers
	Sashkin (1984)	Three types of contingencies when considering participation as an ethical imperative: psychological, organizational and environmental

Table IX: Summary of Theoretical Studies

	UI and UP con-structs	**Methods and Tech-niques**	**Timing and Level of UI**	**Project Success**	**Partici-patory Design**	**IS Project**	**Other**	
Before 1989	2		1	1			1	**5**
1990 – 1999		1		1	2	3	2	**9**
2000 – 2009		6	4	6	3	2	5	**26**
2010 - present						1	1	**2**

	UI and UP constructs	Methods and Techniques	Timing and Level of UI	Project Success	Participatory Design	IS Project	Other	
Total	**2**	**7**	**5**	**8**	**5**	**6**	**9**	**42**

II.7.3 Empirical Research

Barki and Hartwick's original research (1989) that proposed the user involvement and user participation constructs was theory building and did not provide empirical support for these constructs. However, subsequent empirical research provides support for these constructs (Jarvenpaa and Ives, 1991; Kappelman and McLean, 1991). Further analysis of the user attitude construct required that the measures for UI needed to be refined to improve separation of the underlying psychological states (Barki and Hartwick, 1994a). Slevin and Pinto (1987) introduced the Project Implementation Profile – a set of ten critical success factors which their case study illustrates as being necessary. Pinto and Slevin (1988) systematically define project success and 12 measurements in the Project Implementation Profile. Many researchers cite these works as a basis for empirical studies of project success: Brodbeck, 2001; Dvir et al, 2003; Dvir, 2005; Fortune and White, 2006; Khang and Moe, 2008; and Saleem, 1996. We include recent meta-analyses (He and King, 2008, and Harris and Weistroffer, 2009) that each argue for the benefits of UI on IS projects.

Table X provides a summary of the 67 empirical studies and meta-analyses providing 89 findings incorporated in this research along with a brief summary of their contribution to this field of study. All reported studies designate project success or a proxy for project success (such as project performance, user satisfaction or system usage) as the dependent variable unless otherwise noted. Table 11 provides a summary of this analysis. As Table 11 indicates, 87.6% of studies in this area show support for UI in IS projects. Eleven articles in the last 20 years provide contradictory or inconclusive results which support the need for continued research to understand the primary factors influencing project success when users are involved.

Table X: Analysis of Empirical Studies

	Impact	Contribution to the Field
Aladwani (2002)	+	IS project performance is multidimensional
Barki and Hartwick (1994a)	+	User involvement, user participation, user attitude
Barki and Hartwick (1994b)	+	UP impacts Conflict which impacts Satisfactory Conflict Resolution
Barki et al (2007)	+	Identifies three activities to improve conceptualization of system use
Baroudi et al (1986)	+	User involvement impacts project success
Baroudi and Orlikowski (1988)	+	A short form questionnaire to determine user satisfaction
Biehl (2007)	+	Detailed planning, flexibility during implementation, competent leadership, high UI from multiple user groups
Brodbeck (2001)	+ --	Internal communication; user communication in later project phases Use of tools reduces need for communication
Chen et al (2011)	+	User responsibility impacts UP; user influence impacts IS process quality
Dooley, Subra and Anderson (2002)	+	Best practices associated with strategic implementation (which include customer involvement) are more widely adopted
Dvir (2005)	+	Greatest value from UI is found during the development and final user preparation phases
Dvir et al (2003)	+	UI adds value throughout the entire project life cycle, especially the definition of goals and functional and technical specifications
Ewusi-Mensah and Przasnyski (1991)	o	IS projects can be abandoned even when active UP is the norm
Fang (2008)	-- + + o	UP when customer connectivity is high UP when customer connectivity is low UP on speed to market when customer connectivity is high UP on speed to market when customer connectivity is low
Faraj and Sproull (2000)	+	Coordinating expertise positively impacts team performance

	Impact	Contribution to the Field
Filippini et al (2004)	o	Customer involvement is not correlated to NPD time performance
Franz and Robey (1986)	+ o +	UI modestly impacts perceived usefulness of MIS Organizational context has no significant impact on UI User's decision-making and organizational position impacts system usefulness
Geethalakshmi and Shanmugam (2008)	+	The level of customer and user interaction contributes more to project success than other variables studied
Gemino et al (2008)	o	No relationship is supported between organizational support (which includes UP) and project product performance
Ginzberg (1981)	+	Users with realistic expectations of IS performance are more satisfied than users with unrealistic expectations
Harris and Weistroffer (2009)	+	A meta-analysis of 28 papers arguing that UI during the system development process is important to system success
Hartwick and Barki (1994)	+	UP leads to UI, and UI mediates the relationship between UP and system use
He and King (2008)	+	A meta-analysis of 82 studies finding UI impacts attitudinal / behavioral outcomes and to a lesser degree productivity outcomes
Heinbokel et al (1996)	--	UP is related to low project success
Hoda et al (2011)	+	UI is important on Agile projects; its absence can cause challenges
Hsu et al (2008)	+ +	User should provide requirements Continued involvement moderates project risk
Hsu, Chen, Jiang and Klein (2010)	+	Effective UI allowing some level of user control influences project outcomes
Hsu, Hung, Chen and Huang (2013)	+	User coproduction positively impacts project outcomes
Huang and Kappelman (1996)	+	UP helps generate correct system specifications, enables relevant designs and provides a sense of ownership of the results
Huovila and Seren (1998)	+	UI positively impacts project success
Hyvari (2006)	+ +	Communications is a significant contributor to project success Communications in large organizations is even more critical
Ives et al (1983)	+	UP positively impacts user information satisfaction
Jarvenpaa and Ives, 1991	+	Executive participation supports user involvement and user participation
Jiang and Klein (2000)	-- --	Lack of clearly defined roles and general user expertise negatively impact project success Elevated conflict levels decrease the quality of work
Jiang et al (2000)	+ +	Top management and user support impact project team performance Higher levels of agreement promote project success

	Impact	Contribution to the Field
Jiang et al (2002)	+ +	IS staff and customer partnership is critical to success User and systems staff agreeing on system objectives prior to the start of the project is important
Kaiser and Bostrom (1982)	+	Differences between users and IS team members may be due to the Sensing – Intuition personality dimension
Kappelman and McLean (1992)	+	UI and UP are distinct and significant factors affecting IS success
Kappelman et al (2006)	+	Multiple UI and UP factors contribute to IS project success
Khang and Moe (2008)	+	UI and UP throughout all phases of a project is significant
Koch and Turk (2011)	+	Agile methodologies improve information sharing and communication
Kraut and Streeter (1995)	+	Formal and informal communication
Lawrence and Low (1993)	+ +	User representation Management support
McKeen et al (1994)	+ +	User influence and User-developer Communication directly impact user satisfaction UP impacts User Satisfaction and is moderated by Task Complexity and System Complexity
McKeen and Guimaraes (1997)	+	Identify five "basic core" user activities
Melton and Hartline (2010)	+	UI positively impacts new service development performance
Millerand and Baker (2010)	+	Users and developers adopt multiple roles that evolve through the development lifecycle
Peterson and Kim (2003)	+	Cultural standards can impact perceptions of project risk
Pinto and Slevin (1988)	+	Identify 12 measures for project success
Rasmussen et al (2011)	+ + + --	Identify three user groups impacting project success Selecting users based on a representative cross-section of the users may promote systems that satisfy the users' work requirements Weighting user samples towards user advocates provides better results User selection schemes emphasizing users with IT knowledge or experience may systematically bias outcomes that fail to satisfy users
Robey and Farrow (1982)	+	Group meetings provide a means to resolve conflicts
Robey et al (1993)	+ +	UP has moderate positive influence on project success Conflict resolution has large positive impact on project success

	Impact	Contribution to the Field
Saleem (1996)	+	Functional experts with the ability to influence the system design significantly benefit both system quality and system acceptance
	+	Standard information systems may have satisfactory user participation at lower levels
Sethi et al (2001)	+	Senior management's monitoring of a new product development project can be a motivating factor for the team
Soja (2006)	+	Team composition and team involvement are significant across the dimensions of enterprise size, scope and time
Song et al (1998)	+	Participation by different user groups have varying levels of influence by project phase
Sridhar et al (2009)	+	UI positively impacts UP and the quality of IS planning efforts
	+	UP positively impacts the perceived quality of IS projects and the effectiveness of the teams
Verner et al (2005)	+	A high level of customer involvement is the best predictor of project success
Wang et al (2005)	+	A reduction in user-IS conflict can motivate improved project success
	+	Overall project success can be improved by reducing conflict between project team members.
Wang et al (2006)	+	Both management controls and user-IS personnel interaction positively impact project performance
	+	Active management controls positively influence the user-IS personnel interactions
Wang et al (2008)	+	Suggests two types of external roles: consultant and vendor
Wang et al (2011)	+	User advocacy positively impacts project performance
White and Leifer (1986)	+	A range of technical and process skills are perceived as being important to success
	+	The importance of each skill can vary from one phase to another
	+	The tasks in each succeeding project phase became more routine
Whittaker (1999)	+	Senior management involvement is critical to project success
Wu and Marakas (2006)	+	Users with considerable participation in one project phase do not need to have such participation in additional phases to support user satisfaction with the overall project
Yetton et al (2000)	+	UI in all stages of project development increases the chance of project completion
Impact on Project Success:	+ Significant o Non-Supportive -- Contradictory	

Table XI: Summary of Empirical Studies

	UI Impact on Project Success			
	Significant	**Non-Supportive**	**Contradictory**	
Before 1989	12	1		**13**
1990 – 1999	19	1	1	**21**
2000 – 2009	36	5	2	**43**
2010 - present	11		1	**12**
Total	**78**	**7**	**4**	**89**

CHAPTER III

RESEARCH DOMAINS

User Involvement (UI) is considered to be a factor in a number of knowledge domains. This section explores several knowledge domains with active UI research as is organized by topic area. See Table XII for a listing of all articles reviewed in this dissertation.

III.1 Information Systems

Khan, Qurashi and Khan (2011) describe the methodologies originally implemented for Information System (IS) development as "heavy weight" methodologies because of their dependence on relatively large quantities of documentation and task-driven activities; example methodologies are Spiral, Rational Unified Process (RUP), Incremental and Component. These methods require access to knowledgeable and empowered customers while minimizing their time commitment. More modern, "light weight" methodologies have reduced (if not eliminated) the dependence on tasks to favor shorter, faster build cycles and to be responsive to rapid business changes; example methodologies are Prototype, Rapid Application Development (RAD), eXtreme

Programming (XP) and Scrum. These methods require committed, collocated and representative customers that are considered to be full team members throughout the project life cycle. The following sections describe research within specific methodologies.

III.1.1 Participatory Design

Participatory Design (PD) is a socio-technical project methodology that originated from Scandinavia. Sashkin (1984, p, 7) describes PD as a "complex management approach, requiring considerable management support and effort if it is to be implemented and operated effectively". Mursu et al (2007) identify socio-technical information systems as consisting "of information, a technology, system, communication, an organization and people." Bodker and Pekkola (2010) document one of the first known projects using PD for the Norwegian Iron and Metal Workers Union in the late 1970s. Other well-known projects followed such as the Swedish Demos project, the Danish DDE project (Clement & Van den Besselaar, 1993) and the Norwegian UTOPIA project (Bodker & Pekkola, 2010) which emphasizes high levels of collaboration between users and designers. Early projects experienced low levels of management participation; more recent PD projects are encountering a more involved management team. Clement and Van den Besselaar (1993) note that there have been instances of middle management feeling threatened by the highly democratic environments within PD projects and the growing capabilities of the team members below their level. The workers in these teams have been made aware of the social implications of technology noting "that technology is neither neutral nor value-free" (ibid, p. 34).

Kyng (2010) suggests three common themes throughout participatory design research: user involvement throughout the project, prototyping and experimentation of the future state. The original goal was to strengthen the user's voice through the development process. The designers would still perform the major design activities but emphasize communication with users throughout the entire process (Schummer et al, 2006). Floyd (1993) proposes Software Technology for Evolutionary Participatory System Design (STEPS) as an instance of an iterative PD methodology that attempts to anticipate the actual use of a system in production. Ives and Olson (1984) argue that user participation can be viewed as a special case of PD. Loebbecke and Powell (2009) argue that the trifurcation (separating PD into participatory design, action research and design science) is actually inhibiting discovery of valuable insights because of the artificial walls between these models.

The benefits of PD have been seen in a variety of settings. For example, a Jungian analysis of users led Kaiser and Bostrom (1982) to an action-research analysis that supports a socio-technical approach. However, one common theme throughout PD projects is the failure of these efforts to maintain their momentum; once the key players leave or the project ends, the interest in PD methods disappear (Pilemalm and Timpka, 2008). Clement and Van den Besselaar (1993) suggest that this can be addressed by having users accept the roles of animators (maintaining repeated discussions of the goals, plans and rationales) and increasing the number and intensity of PD champions to communicate and promote its benefits. Bjerknes (1993) proposes other lessons learned such as ensuring management support, specifying levels of user time commitments, creating a steering group to resolve conflicts, listening to the users throughout the project, and not forgetting the users when performing predominantly technical steps (such as the physical deployment of the system).

Participation by users involves providing the users some level of control over their current and future work settings. Mumford and Weir (1979, p. 11) argue that ETHICS (Effective Technical and Human Implementation of Computer Systems – a participative systems design methodology) seeks "the attainment of a good 'fit' between what the employee is seeking from his work … and what he is required to do in his job" by including the interested users during the design process. Specifically, they identify five dimensions of fit: knowledge, psychological, efficiency, task-structure and ethical (social value). Muller, Wildman and White (1993) propose taxonomy of participatory design showing that PD can be applied to a wide range of projects whether the designers participate in the user's world or users directly participate in design activities. Along another dimension, it suggests that user participation can become active from early in the development cycle to much later in that development cycle. There have also been studies in single industries, such as health informatics (Pilemalm & Timpka, 2008) and the Health Information Systems Programme (HISP) (Titlestad, Staring and Braa, 2009). Pilemalm and Timpka (2008) include a summary of first generation PD projects (intended to enhance workplace environments and task variety) and second generation PD projects (emphasizing team work in commercial environments) but note that even after these efforts, implementation in large product-oriented development projects remain scarce. They suggest that third generation PD methodologies will have to incorporate organizational trends with mechanisms to allow flexible workplaces. In a study of distributed development, Titlestad et al (2009) specifically note how the use of the internet enables participatory design across space and time dimensions.

An extension of Scandinavian sociotechnical action research[11] developed the concept of "model power". Buhl and Richter (2004, p. 271) recognize the sources of model power allowing the teams to focus on creating "conditions for communication emphasizing form and process rather than power and structure" resulting in reduced stress and improved communications. The authors propose ten "tools" for positive change and discuss their use in two case studies (ibid, pp. 258-259, Table 2).

Another special instance of PD is Human Computer Interaction (HCI). Cahill and McDonald (2006) explore this method through the design of an electronic flight bag for use by commercial pilots where the pilot's situational awareness must be maximized thereby requiring the minimization of distractions from inefficient workflows, confusing information displays or overall workload. The principal orientation "is the idea that usability engineers design 'with' end users as opposed to 'for' them" (ibid, p. 115). This case study details user interviews, user testing, ethnographic interviews and observations, and task analysis steps were described in this case study. The advantages of this approach include the ability for technology to envision the final result (i.e., provide a high fidelity prototype) and a demonstration of the value of concentrated design sessions with real users in real situations. However, three disadvantages are noted. Typical PD methods do not use a study of actual practice and technology usage in real world

[11] O'Brien (1998, p. 3) defines action research as "learning by doing" … emphasizing scientific study while the researcher is embedded in the immediate problematic situation.

situation. The opportunity for designer bias is pervasive. Finally, the proposed systems must be validated through evaluations by not only the original team but new users that are not slanted based on their prior knowledge of the proposed solution.

III.1.2 User Centered Systems Design

User-centered systems design was developed through the 1980s and coined by Norman and Draper (1986). Although it has been studied and practiced in many scenarios, there is no single definition in use. However, 12 principles of its application and use have been published by Gulliksen et al (2003). Four of these twelve principles explicitly involve the user (user focus, active user involvement, usability champion and a user-centered attitude) while the others imply their participation to some degree (ibid, pp. 401-403). The authors note that Agile methodologies specifically address some of the development weaknesses found in the authors' experiences. For example, they argue that communication is critical to project success and that Agile projects value being communication centric as a method to combat that weakness.

One tool for capturing user requirements is a "use case" or "user stories"[12]. Johansson and Messeter (2005, p. 232) characterize users with "personas" described as "rich but static descriptions of fictive users". The authors argue for actual involvement by real users (with their associated complexity and inconsistencies) as opposed to representations of users, thus gaining the benefit of including social and political dimensions.

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[12] Wake (2003) defines a set of criteria describing well written use cases or user stories called "INVEST".

III.1.3 Rapid Application Development

Beynon-Davies et al (2000) define Rapid Application Development (RAD) as a project methodology that emphasizes high levels of user participation and frequent prototyping to address business uncertainty and development uncertainty. The methodology has a number of similarities to aspects of participatory design. The authors suggest that users often have the role of project managers (ibid, p. 206) while being required to engage with development work not common to business users (ibid, p. 215). The use of scenarios and design breakdowns can be instrumental in expanding the communications between users and developers (Beynon-Davies & Holmes, 2002).

Although the intent of the RAD methodology is to empower the team to make decisions and they typically make decisions without input from external sources, one case study did experience external management critique early in the project to which the team performed rework to meet their concerns and needs (Beynon-Davies et al, 2000). This exhibited the possibility for negotiation regarding the actual level of empowerment provided the team. Realistically, the level of user involvement must allow for their time on the project to incorporate their other work.

III.1.4 Agile Development

Early IS methodologies were plan-driven in that they focused on generating detailed plans of tasks to be performed and then monitored the execution of that plan. The Agile development framework was developed as a response to such bureaucratic methodologies. Hoda et al (2011) states that the term “Agile” is itself an umbrella term for such methods. Zmud (1980) notes that an expected result of iterative development would be reduced documentation requirements because of user participation and more advanced technologies.

The Agile Manifesto (Highsmith, 2001a) defines the four sets of prioritized values of the Agile framework – individuals and interactions over processes and tools, working software over comprehensive documentation, customer collaboration over contract negotiation, and responding to change over following a plan. Its twelve principles outline the framework for a customer-centric, faster-paced development approach. The Agile Manifesto's history page (Highsmith, 2001b) explains that an Agile environment "does more than talk about 'people as our most important asset' but actually 'acts' as if people were the more important, and lose the word 'asset'". Two of its major objectives are to engage users at all levels of the organization during design and to include job satisfaction as part of the definition of system success (Siakas & Siakas, 2007). Continuous access to active users is another primary feature of Agile. Agile emphasizes user satisfaction as a result of their active participation in adaptive processes. Hoda et al (2011) considers customer collaboration to be a vital feature of Agile software development but also states that a continuous customer presence on a project may, in practice, be unsustainable. They also argue that Agile methodologies advocate high levels of collaboration between business and technical team members for the purpose of generating frequent production releases of working software.

High frequency iterations provide multiple opportunities for users to provide feedback as the product develops. Zmud (1980) introduces the idea of relatively short development iterations specifically to address the unreliable schedules developed when only one development and implementation cycle was planned. Hoda et al's (2011, p.

525, Fig. 3) study of software development firms in New Zealand and India note that iterations range from 1 to 4 weeks. A portion of this approach includes the development of a prototype so that sponsors (i.e., users) can experience the product directly.

Kelly (2011) proposes a 10 step model for Agile methods that enhances the activities performed for requirements management. One of the principles is involvement by the customers or end users who will actually use the end product. Nelson's (2007) study of "infamous failures, classic mistakes and best practices" finds that if the requirements have not been well defined or significant user involvement is needed, then an Agile approach is recommended.

Mumford (1983, 1993) created the ETHICS methodology which is based on organizational behavior constructs that emphasize participation by a wide range of users during decision making; its age makes it a precursor to Agile methodologies. Wells (1999) describes eXtreme Programming (XP) which emphasizes having the customer always being available as one of its few requirements throughout the entire development life cycle. The primary benefits are listed as reducing the overall user commitment necessary to specify requirements prior to any development beginning and the time savings from deploying a functioning system from the users' vantage point. Schwaber and Sutherland (2011) document the popular Scrum methodology specifically designed to implement Agile concepts for IS projects.

III.1.5 Quality Assurance

III.1.5.1 Quality Assurance Activities

Hutcheson (2003) provides an approach to quality assurance. The author advocates the creation and use of a test inventory ("the complete enumeration of all known tests;

path, data module, design, system, and so on", ibid, p. 388) which is used to organize the test cases, execute the tests and determine test coverage ("the percentage of everything that could be tested that was actually tested", ibid, p. 388). Hutcheson (2003), Iacob and Constantinescu (2008) and Olalekan and Adenike (2008) recommend the use of quality assurance tools and methods to organize, document and report on the quality assurance progress as well as reducing time spent on repetitive tasks that modern tools can automate. Individual test cases should be written in such a way that they identify the test conditions, show traceability to the requirements, contain the expected result and are executable (Iacob and Constantinescu, 2008). One of the Project Management Institute's (PMI) nine knowledge areas is Quality Management that contains three primary processes: Plan Quality, Perform Quality Assurance, and Perform Quality Control. Plan Quality is the set of activities related to identifying and specifying the specific tests to perform; Perform Quality Assurance is the actual execution of the individual test cases to validate whether predefined quality standards are being used; and Perform Quality Control is the monitoring of quality progress and recommending necessary changes.

III.1.5.2 Utilizing Prototypes

Participatory Design recommends the use of prototypes throughout the project life cycle (Cahill and McDonald, 2006; Campbell et al, 2007). Human Computer Interaction argues for the use of high fidelity prototypes for visualizing the final product. Rapid Application Development also argues for the use of frequent prototyping to reduce risk during and after the project development life cycle. Agile methodologies encourage frequent prototyping as a means to engage sponsors to directly experience the product.

New Product Development (NPD) research also supports the use of prototypes as a primary tool of product verification; they allow for verification throughout the development process rather than waiting until the final product appears and discovering, too late, that there are problems. They also argue that for NPD, there is often an element of discovery for customers and developers as the research and design phases are underway. Prototypes help team members discern problems and issues earlier in the development life cycle which may generate changes to the purpose or attributes of the desired product or service. IS developers can gain a better understanding of customer needs as they interact with their customers experience the prototype.

The customer provides value when engaged in a verification role throughout the new product development life cycle (Campbell, et al., 2007, p. 618). The product prototype becomes the primary vehicle for communicating this feedback. The form of the prototype is evolving towards virtual prototypes as technology advances towards this capability. It may be that virtual prototypes do not provide the necessary tactile representation of the finished product to detect anomalies (ibid, p. 619). They note that designers and end users must actively engage through the entire design process.

Use of prototypes in IS projects is one technique that has been successfully used to improve software product quality (Tudhope et al, 2000; Khan et al, 2011). Kristensson et al (2008, p. 485) argue that users experiencing a prototype provide better ideas than "undifferentiated and directionless brain-storming activities". Participatory design methodologies benefit from the use of prototypes by allowing teams to visualize future products and services (Cahill and McDonald, 2006). Campbell et al (2007, p. 633) find that functional prototypes enable analysis of all design criteria and "act as a catalyst for stimulation of further ideas and development". McKeen and Guimaraes (1997) suggest that prototypes are one of the least studied user activities.

III.1.6 Project Management Activities

The process of developing an information system takes time. As the project progresses, the team must stay synchronized with the business users and their potentially changing requirements. Barki et al (2007), Chen et al (2011), and Wang et al (2005) study the effect of communication with non-IS personnel. Fang (2008), Sridhar et al (2009), and McKeen and Guimaraes (1997) study the project's schedule on user satisfaction. This is important since there could be complications if the system is implemented either too early or too late. Wang et al (2005) study conflict management. Since projects, by their very nature, are high risk endeavors, conflicts must be quickly addressed. Information systems typically have a relatively short period of time when they are installed into their production environment; this process is called "implementation". Franz and Robey (1986) note that UI in pre- and post-implementation periods contributed to a smooth implementation of an information system; Wagner and Newell (2007) find similar results related to post-implementation activities. McKeen and Guimaraes (1997), White and Leifer (1986), Doll and Torkzadeh (1989), Kappelman and McLean (1991), and Kappelman and McLean (1992) also support UI during implementation phases of IS projects. PMI's Project Management Body of Knowledge (PMBOK®) includes the process of implementation in "knowledge area" of Project Integration – specifically that knowledge is transferred from the project team to the operations and user groups.

Keil and Robey (1999) identify twelve factors that enable de-escalation on distressed projects: change in top management support, external shocks to the organization, change in project champion, organizational tolerance for failure, the presence of publicly stated resource limits, consideration of alternative uses of funds supporting a project, awareness of problems facing the project, visibility of project costs, clarity of criteria for success and failure, organizational practices for evaluating decision makers, regular evaluation of projects, and separation of responsibility for approving and evaluating projects.

III.1.7 Project Management Methodologies

Khan et al (2011) acknowledge that "heavy methodologies" depend on knowledgeable and empowered customers but these same methodologies work to minimize their time involvement whereas the more modern "light methodologies" require committed, collocated, and representative customers. It is the lighter more agile methodologies that strive for greater UI and UP to benefit from the customer's experience, knowledge and acumen to address the weaknesses of the earlier methodologies (i.e., task orientation and plan driven). Beynon-Davies et al (2000) find that although there are benefits from high levels of user involvement, management must allow for the possibility of their user's time being required on non-project activities.

Participatory Design specifically addresses the socio-technical dimension where technology and personal / organizational behavior meet. Proponents of this methodology are involved throughout the project development life cycle, expect to examine and experiment with prototypes, and help design their future states. Technology itself can enable high communication between geographically dispersed teams (Titlestad et al, 2009). Gulliksen et al (2003) note that User Centered Systems Design also focuses on customer involvement. Johansson and Messeter (2005) describe the concept of a persona for use in describing system requirements from the point of view of an actual user. Rapid Application Development emphasizes high levels of user participation to address business and development uncertainties. Highsmith (2001b), as previously noted, argues that an Agile environment "does more than talk about 'people as our most important asset' but actually 'acts' as if people were the more important, and lose the word 'asset'".

III.1.8 Methodology Weaknesses

Beath and Orlikowski (1994) find that a source of poor user participation can be the development methodology itself. Their study uses deconstruction of one popular methodology (Information Engineering) to identify internal contradictions. The analysis concluded that although the users have ultimate responsibility for the system, they are not given the position, tools or opportunity to guide its design and development. Two sets of contradictions follow as illustrations:

- Eight citations from the methodology state the importance of user involvement, which are then contrasted with eight citations stating how users can have part-time roles, are guided by analysts, given only brief training, various portions of the models must be explained to them, etc. (ibid, pp. 358-366)
- Communication is shown to be led by the analysts; user involvement must be "managed" through "props" and "settings", even explicitly stating that "users cannot design complex procedures without professional help" (ibid, pp. 360-369)

III.2 New Product and Service Development

The well-studied domain of New Product Development (NPD) has identified customer involvement as being mandatory at the start and end of these projects with the frequently observed negative effect of limiting their involvement to these stages (Campbell et al, 2007). Sethi et al (2001) find that the number of firms using cross functional teams for NPD is increasing. Consistent customer involvement throughout the entire product development life cycle leads to improved outcomes because of the frequent positive and corrective feedback provided by the customer participation. Dooley et al's (2002) study of NPD best practices (characterized by their strategic value including customer involvement) finds that they are more widely adopted on average than best practices associated with controlling the development process.

Some information systems have many characteristics of providing a service. Alam and Perry (2002) propose that customer involvement is even more significant on New Service Development (NSD) efforts than for manufactured products. Melton and Hartline (2010) conducted empirical studies on service firms and found that customer involvement on service projects generally have positive impacts on the project's success.

Fang (2008) finds that the manufacturing domain is experiencing a significant growth in the involvement of industrial customers during new product development efforts. Customers are able to articulate their needs and are willing to be more involved with their design, development and delivery. However, their empirical study found insignificant impacts to either new product innovativeness or speed to market in most scenarios studied (whether the customers performed as information sources or as co-developers).

Lettl (2007) defines the conceptual framework of user involvement competence as having two dimensions; the first identifies which users can perform effectively on innovation projects while the second requires an understanding of the patterns of collaboration between the users and other team members. The author also acknowledges the temporal aspect of user involvement; i.e., that effective UI can vary by project phase.

III.3 Psychological

Users have on many occasions been studied as one-dimensional constructs. However, the field of psychology has significant experience analyzing a person's involvement with issues. For example, Sherif, Sherif and Nebergall (1965) find that a person's involvement with an issue will tend to cause them to have a more positive attitude about that issue.

Fishbein's Theory of Reasoned Action (1980) influenced Barki and Hartwick's (1989) research of user involvement on information systems development in which the author expands user involvement to include the psychological dimension. What had previously been measured as a single set of activities or tasks was enhanced to have two dimensions: "User Involvement" representing the subjective psychological state of the individual, and "User Participation" representing user activities and behaviors. Newman and Robey (1992) used process models of the user-analyst relationship which suggest that there is some predictability originating from the antecedent condition, episodes (sets of activities) and encounters (demarcation points between episodes)[13]. Kaiser and Bostrom's (1982) use of Jungian typology (operationalized by the Myers-Briggs Type Indicator) was used to compare and contrast personality types between users and IS team members as a possible moderating factor explaining differences between various characteristics. They find that only the Sensing – Intuition dimension was significant between the two groups, and that there were more users in their sample with strong Sensing – Thinking tendencies – greater than the number of IS team members with the same Sensing – Thinking tendencies.

The studies of attitudes and their change have included user involvement in many forms but they tend to emphasize the social process, the subject's importance to the person, its effect on change and its personal relevance (Sherif, Kelly, Rodgers, Sarup and Tittler, 1973; Apsler and Sears, 1968; Newman and Robey, 1992). Leippe and Elkin's (1987) study of highly involved individuals find that they recall information quickly and when presented with strong arguments are more likely to be influenced by those arguments. Both Leippe and Elkin (1987) and Sherif et al (1973) find that when users have positive attitudes, they are more likely to act consistently with their attitudes, whereas if they hold negative attitudes, they are not as likely to present the same behaviors or hold the same objectives. Ginzberg (1981) suggests that early identification

[13] Typical factor models that investigate predictor-outcome relationships infer causation but don't explain how the outcomes actually occurred, whereas process models presuppose dynamic attributes related to the sequence of activities which in turn can better explain the outcomes being measured. Kline (2005, pp. 93-95) explains the conditions to reasonably infer causality: time precedence, explicit relational direction, and association persistence.

of warning signs can save significant amounts of time and money. The early warning signs of failing projects indicate differences between the expectations of IS staff (designers) and IS users. Users with realistic expectations are found to use the systems more and have greater satisfaction. Jiang et al (2000) use a social perception model to confirm differences in perceptions of performance ratings and satisfaction between IS users and IS staff.

The issue may no longer be whether to involve the user, but rather, how to best involve the user within some understanding of the difficulties with their involvement on projects. Heinbokel et al (1996) argue that users are the only real source of knowledge about their needs, so it can be further argued that usable software can only be developed with their participation. Their empirical study included the concepts of user participation (involving a user representative) and user orientation (pertaining to positive attitudes towards users). The findings showed negative relationships between these constructs and process and product quality. The authors warn that one should not eliminate user participation because of their findings, but that researchers need to understand the types of problems that are experienced and how to best ameliorate them.

He and King's (2008) recent meta-analysis finds that user participation may only be minimally-to-moderately beneficial to system development projects with the dominate influence being on attitude and behavioral changes rather than productivity.

III.4 Organizational Behavior

III.4.1 Background

Early research of involvement with work identified three discrete definitions of user involvement in the work place. Bass (1965) and Wickert (1951) define this concept as being oriented towards the degree the individual is encouraged or allowed to participate on the job. A second definition given by Lodahl and Kejner (1965) is the extent to which one's sense of worth is affected by their job performance. Finally, Lawler and Hall (1970) expand that definition to define user involvement organizationally as the extent to which the person identifies psychologically with their work. These definitions correspond to the definitions of UI used in information systems development, psychology and marketing. Kanungo (1979, 1982) suggests that the lack of definitional consensus is specified in four separate areas. The list includes inconsistent measurements, a lack of separation between the definition, its antecedents and subsequent effects, other possible emotional states, and a lack of clarity between job involvement and intrinsic motivation. Kanungo further suggests that the best definition is related to the psychological state associated with one's job, which is consistent with psychological and marketing research.

Petter (2008) argues that the user's expectations of project outcomes are a significant factor in the user's satisfaction with the outcomes, as stated in expectation-confirmation theory. Managing user expectations is necessary to control the difference between their anticipated benefits and the actual product's functionality. The project manager plays a key role by involving the user in actual decision making by communicating the user's value, timely, open and direct communication of good and bad news, providing data for better joint decisions, and involving large numbers of users.

III.4.2 Dimensions

Ives and Olson (1984) note that two principal areas of organizational behavior study are Participative Decision-Making (PDM) and Planned Organizational Change (POC). PDM seeks to obtain input from actual workers for management to improve productivity while simultaneously increasing job satisfaction, however research by Locke et al (1986) finds little empirical support. If you substitute users and developers into PDM's subordinates and management, user involvement becomes a special case of PDM (ibid, p 587). Ives and Olson (1984) note that POC theory states that information system success depends on the implementation process' quality where the process quality is obtained by managing involvement as a means to motivate positive attitude change.

Organizational theory has recognized that users can have multiple simultaneous roles. Millerand and Baker (2010, p. 152) use this dynamic characteristic in the Integrative Design Model to identify three roles: user representatives, co-developers, and co-users. Fardal's (2007) study using grounded theory[14] finds that user participation was the highest ranked success factor when considering the alignment of User Management Alignment. Robey and Farrow (1982) find that users with multiple simultaneous roles tend to have a higher potential for incompatible goals.

Cultural characteristics can affect organizational behavior and should be included in organizational behavioral models to have a complete understanding of user involvement. For example, Muriithi and Crawford's (2003) study of African project management practices finds that a top down approach to establishing direction and scope is to be encouraged because of their cultural and community norms. Design sessions that involve multiple levels of the organization will not be effective because lower level team members will feel suppressed and limit their contributions which will limit the

[14] Rhine (2008) defines Grounded Theory as an inductive methodology that systematically generates theory from systemic research.

requirements necessary to obtain successful project outcomes. Peterson and Kim (2003) compare perceptions of project risk between American, Japanese and Korean IS professionals. They found that there are differences between how projects are estimated and developed based on the different cultural assumptions between countries.

The socio-political nature of organizations can also affect a project's success. Robey and Markus (1984) find that a rational view of system development is motivated by a desire to enhance task performance and organizational effectiveness. This rational view also stimulates appropriate use while being supported through methodological components such as project life cycle management, roles and responsibilities and user participation. The same study describes the "political process" within firms (characterized by motivation and opportunity) and identifies differences between users and developers where users are motivated by control and affected by their departmental affiliation (ibid, p. 11). The combination creates "rituals in systems development … [that] symbolize rationality" so that "systems which appear to be rationally justified also serve political aims" (ibid, p. 12). The two views – rational and political – are not mutually exclusive but present differing interpretations of the process and product.

III.5 Marketing

Krugman (1967) and Mitchell (1979) find that research in marketing is consistent with that of psychology in that there is no single precise definition of involvement but it refers to a personal relevance of the article or event. Laurent and Kapferer (1985) propose multiple dimensions of involvement including "importance" and "pleasure", which correspond to the psychological dimensions of personal relevance and attitude respectively. Individuals with high involvement tend to zealously argue for and against the object (Gardner, Mitchell, and Russo, 1985; Wright, 1973). Petty, Cacioppo and Schumann (1983) expand that idea and note that attempts to change such attitudes with weak arguments will likely be ineffective while strong arguments are likely to be more effective.

III.6 Other Domains

Customer involvement has been studied in other domains as well. For example, in the construction industry, one of the few tools that involve customer needs during the product design phase is Quality Function Deployment (QFD). Huovila and Seren (1998) indicate that greater levels of customer involvement positively impacted project success. Cowan et al (1992, p. 5) study of project partnering defines it as “a method of transforming contractual relationships into a cohesive, project team with a single set of goals and established procedures for resolving disputes in a timely and effective manner”. Larson (1997) studies the application of project partnering on construction projects. The author finds that all major partnering activities are positively related to one or more measures of project success. Further, some of the project partnering activities (such as establishing an assumption of a fair profit for the contractor and conducting team building sessions) were most effective when established early in the project life cycle.

Table XII: Journals by Knowledge Area and Journal Type

Knowledge Area \ Journal Type		Information Technology / Information Systems	Project Management	Other (Psychology, Organizational Behavior, Marketing, Engineering, Operations Management)
Information systems				
	Participatory Design	Bjerknes (1993), Bodker and Pekkola (2010), Clement and Van den Besselaar (1993), Damodaran (1996), Floyd (1993), Kyng (2010), Loebbecke and Powell (2009), Muller et al (1993), Mumford and Weir (1979), Titlestad et al (2009)		Buhl and Richter (2004), Howcroft and Wilson (2003), Mumford (1983), Mumford (1993)
	User Centered Systems Design	Johansson and Messeter (2005), Norman and Draper (1986)		Gulliksen et al (2003)
	Rapid Application Development	Beynon-Davies and Holmes (2002), Beynon-Davies et al (2000), Tudhope et al (2000)		
	Agile Development	Ansari. Sharafi and Nematbakhsh (2010), De Lucia and Qusef (2010), Highsmith (2001a, 2001b), Hoda et al (2011), Hsu et al (2013), Kelly (2011), Khan et al (2011), Koch and Turk (2011), Mahanti (2006), Schwaber and Sutherland (2011), Siakas and Siakas (2007), Wake (2000, 2003, 2009), Wells (1999), Zhang et al (2010)		
	General	Aladwani (2002), Amoako-Gyampah and White (1997), Ariyachandra and Frolick (2008), Barki and Hartwick (1989, 1994a, 1994b), Barki et al (2007), Baroudi and Orlikowski (1988), Baroudi et al (1986), Beath and Orlikowski (1994), Beatty et al (2011), Bevan (2000), Biehl (2007), Biffl et al (2006), Boddie (1987), Burns and Stalker (1961), Canel et al (1997), Cavaye (1995), Chakraborty et al (2010), Chen et al (2011), Coombs et al (2001), Dean et al (1997),	Cowan et al (1992), Dvir (2005), Dvir et al (2003), Fortune and White (2006), Garrety et al (2004), Hyvari (2006), Jiang et al (2000), Jiang et al (2002), Khang and Moe (2008), Muriithi and Crawford (2003), Petter (2008), Pinto and Slevin (1988), PM Hut (2009), Project Management	Ayeni (2008), Brodbeck (2001), Cahill and McDonald (2006), Faraj and Sproull (2000), Franz and Robey (1986), Ginzberg (1981), Gulliksen et al (2003), Hartwick and Barki (1994), Heinbokel et al (1996), Ives and Olson (1984), Ives et al (1983), Jiang and Klein (2000), Jones (2003), Leavitt and Whisler (1958), Leonard (2004), LePage (2009), Mahring (2002),

Knowledge Area \ Journal Type		Information Technology / Information Systems	Project Management	Other (Psychology, Organizational Behavior, Marketing, Engineering, Operations Management)
		DeLone and McLean (1992, 2003), Doll and Torkzadeh (1988, 1989), Fardal (2007), Fuller et al (2008), Gallivan and Keil (2003), Geethalakshmi and Shanmugam (2008), Gemino et al (2008), Grover et al (2007), Guinan and Faraj (1998), Harris and Weistroffer (2009), Havelka and Rajkumar (2006), He and King (2008), Hsu et al (2008), Huovila and Seren (1998), Hutcheson (2003), Iivari (2009), Iivari et al (2010), Jarvenpaa and Ives (1991), Jiang et al (2002), Kamadjeu et al (2005), Kappelman and McLean (1991), Kappelman et al (2006), Kearns (2007), Keil and Robey (1999), Kelly (2011), Kraut and Streeter (1995), LaPlante (1995), Laudon and Laudon (2005), Lawrence and Low (1993), Lin and Shao (2000), Liu et al (2010), Luftman et al (1993), Markus and Mao (2004), Martin et al (2007), McFarlan and McKenney (1983), McKeen et al (1994), McKeen and Guimaraes (1997), Melville et al (2004), Millerand and Baker (2010), Montazemi et al (1996), Mursu et al (2007), Nah and Delgado (2006), Nelson (2007), Newman and Robey (1992), Ngai et al (2008), Nidumolu and Subramani (2004), Olalekan and Adenike (2008), Olsson (2008), Peters (1999), Peterson et al (2003), Philip et al (2010), Qasaimeh and Abran (2011), Rasmussen et al (2011), Ravichandran and Rai (2000), Robey and Markus (1984), Robey et al (1993), Saleem (1996), Schummer et al (2006), Soja (2006), Sridhar et al (2009), Subramanyam et al (2010), Swanson (1974), Tait and Vessey (1988), Terry (2008), Tesch et al (2007), Turner (1990), Verner et al (2005), Wagner and Newell (2007), Wagner and Piccoli (2007), Wang et al (2005), Wang et al (2006), Wang et al (2008),	Institute (2008), Reich and Wee (2006), Wang e al (2011)	Motwani et al (2002), Pilemalm and Timpka (2008), Robey and Farrow (1982), Robey et al (1989), Sharma et al (2009), Sheu and Kim (2009), Sioukas (1994), Slevin and Pinto (1987), Somers and Nelson (2001, 2004), Sudhakar et al (2012), Upton and Staats (2008), Wu and Wang (2006)

Journal Type / Knowledge Area	Information Technology / Information Systems	Project Management	Other (Psychology, Organizational Behavior, Marketing, Engineering, Operations Management)
	Weill and Broadbent (1998), White and Leifer (1986), Whittaker (1999), Wiegers (1997), Wu and Marakas (2006), Yetton et al (2000), Yourdon (1993), Zmud (1980)		
New Product and Service Development			Alam and Perry (2002), Campbell et al (2007), De Moor et al (2010), Dooley et al (2002), Fang (2008), Kristensson et al (2008), Melton and Hartline (2010), Sethi et al (2001), Song et al (1998)
Psychology	Kaiser and Bostrom (1982), Kappelman and McLean (1992)		Apsler and Sears (1968), Baron and Kenny (1986), Kanungo (1979, 1982), Lawler and Hall (1970), Leippe and Elkin (1987), Lodahl and Kejner (1965), Sherif et al (1965), Sherif et al (1973), Zanna and Rempel (1988)
Organizational Behavior	Ewusi-Mensah and Przasnyski (1991)		Huang and Kappelman (1996), Locke et al (1986), Sashkin (1984), Vancouver and Schmitt (1991), Wickert (1951)
Marketing			Gardner et al (1985), Laurent and Kapferer (1985), Mitchell (1979), Wright (1973)
Other			Bettencourt et al (2002), Filippini et al (2004), Fishbein (1980), Jaikumar (2001), Krugman (1967), Larson (1997), Lettl (2007), Petty et al (1983), Rhine (2008), Shin et al (2000)

CHAPTER IV

LITERATURE SUMMARY

This section summarizes the extensive literature review in a manner that addresses our research questions.

IV.1 Business Users

Many studies show the relationship between UI and various project activities. However, prior research uses relatively limited sample frames or employs models with few independent variables and a single output variable for their empirical studies. For example, some studies only survey product managers in the manufacturing industry, one study surveys both information technology team members and business users, but propose a model with a single latent variable[15], another study limits their sample frame to users for only new IS systems to be developed in-house, one reported that their typical respondent was the Vice President or Director of Engineering or Marketing, and yet

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[15] Latent variables are unobservable variables that can be exogenous (independent) or endogenous (dependent). They are typically represented by multiple directly measurable variables (Shah and Goldstein, 2006, p. 149).

another study surveyed only end users. Few empirical studies have focused exclusively on the business user in all their roles (executive management, support, middle management and non-management) as their sample frame. This limits the applicability of the findings by practitioners.

IV.2 User Activities

IV.2.1 Requirements

The process of gathering business requirements has traditionally been considered to be a single construct. Table II documents that 16 of 19 studies suggest that there is a second classification of business requirements that focus on how the user interacts with the information system – i.e., the Presentation Requirements. These address the human interface to the information system including the input and output forms, specific screen formatting and layouts, report designs and user queries to provide a search capability to the user. They focus heavily on the way a user needs to interact with the information system so that the design of the interface(s) do not distract or inhibit the user's productivity. This large number of articles in literature referring to a second grouping of requirements brings into question whether a single requirements construct sufficiently describes the requirements gathering activity.

IV.2.2 Quality Assurance

Designing a new product or service involves a process of discovery, i.e. learning what is feasible from the technology and environment while simultaneously realizing what business users truly want from the system. This "feedback loop" (create an initial prototype, experience it, detail revisions and enhancements, implement the next version, etc.) enables the analysis and design phases to be performed synchronously by the designers, builders, and users. The feedback loop includes a validation of the user's needs compared to the product or service being developed. The continuous improvements from such involvement may be due to two drivers. First, the users become more aware of system capabilities and their true information processing needs as time (and therefore use) increases their knowledge of system functionality. Second, IS professionals tend to comprehend the user requirements better once they have both experienced the new system (i.e., after experiencing a prototype). This value proposition, called "learning by doing", generates "value-in-use". Since users have difficulty describing their latent needs with technology-based services, the experience of simultaneously experiencing their needs and conceiving possible solutions by interacting with one or more prototypes facilitates the documentation of their latent needs.

IV.2.3 Project Management

Practitioners understand that various project management activities require a range of user involvement that can vary from occasional consultation to full-time active engagement. Project schedules that can impact business users or their systems must be coordinated with the business community to minimize those impacts. Conflicts and risks that occur are often not fully understood by the development community so the advice and guidance from business management is necessary. Project progress is best communicated to the business community by the business team (users and management closely involved with the project). Finally, the implementation of the system into the production environment is best guided by business users so that user training, data migration and customer communication meets expectations.

IV.3 User Satisfaction

Many research studies have attempted to measure "project success", "project performance" and "user satisfaction". The consensus is that although there are some definitions of this construct that include both subjective and objective measures, it is fundamentally dependent on the end user's perception of their satisfaction. Information systems exist to benefit users and users are the primary people who can fully appreciate the value to be derived by their use. Users from multiple disciplines and with differing roles and responsibilities consider project performance by multiple and sometimes different measures as confirmed by social perception models. User Satisfaction is a multi-dimensional construct that includes process measures (predominantly related to objective measures such as budget, time and scope) and product measures. The product measures can be further divided into those that convey the degree to which the system meets the business objective that motivated the information system and those that convey the technical implementation and support of the system.

IV.4 Comprehensive Model

The literature contains many recommendations for a more comprehensive model to be studied to enhance our understanding of the constructs and their relationships. The motivation to resolve the inconsistent and occasional conflicting findings in the literature comes from studies documenting weak theory development, questionable construct definitions, inconsistent measurement instruments, and inappropriate methodology. The specific requests for an improved model include incorporation of multiple user activities, multiple performance measures (user satisfaction), and a sample set that includes business users (excluding IS staff and management) from multiple industries. Finally, this new model should integrate the most current findings from literature.

CHAPTER V

MODEL DEVELOPMENT

Barki and Hartwick (1989) propose two possible avenues for developing a theoretical framework. First, continue the proposals by Swanson (1974) that suggest that user involvement produces positive attitudes toward the system which in turn produce greater use of the system. The second was to follow Ives and Olson (1984) where they argue for the presence of one or more mediators between user involvement and project development outcomes. This research is influenced by Ives and Olson (1984) since the literature has followed that approach. We will define user involvement as the activities and behaviors performed by business users on these projects.

The literature further highlights the need for a more complex model that incorporates the use of multiple user activity constructs, multiple performance measures, multiple industries, and the perspective of the ultimate business user (Wang et al, 2005; Doll and Torkzadeh, 1989). This section describes the development of a more comprehensive model, specifically the Multiple Factor User Satisfaction (MFUS) model, that addresses these research concerns to advance our understanding of user satisfaction as perceived by the business users themselves. We follow the guidance suggested by Malhotra and Grover (1998) regarding survey-based research.

V.1 Model Design

Studies conflict on whether to recommend UI throughout all phases of a project (ex: Dvir et al, 2003; Fortune & White, 2006; Hoda et al, 2011) or limit UI to selected phases of a project (ex: Filippini et al, 2004; Franz & Robey, 1986; LePage, 2009). We acknowledge this dimension of UI research and for the purpose of maintaining parsimony; we do not include an analysis of UI by project phase. Our focus on user activities is essentially an analysis of UI by the project's work breakdown structure[16] and not an analysis of a project schedule network diagram[17]. Our model assumes that users are involved throughout all phases of an IS project[18] and employs a cross sectional design using a single survey instrument. Figure 3 is the basic model that is developed in this section; Figure 4 is the fully developed model.

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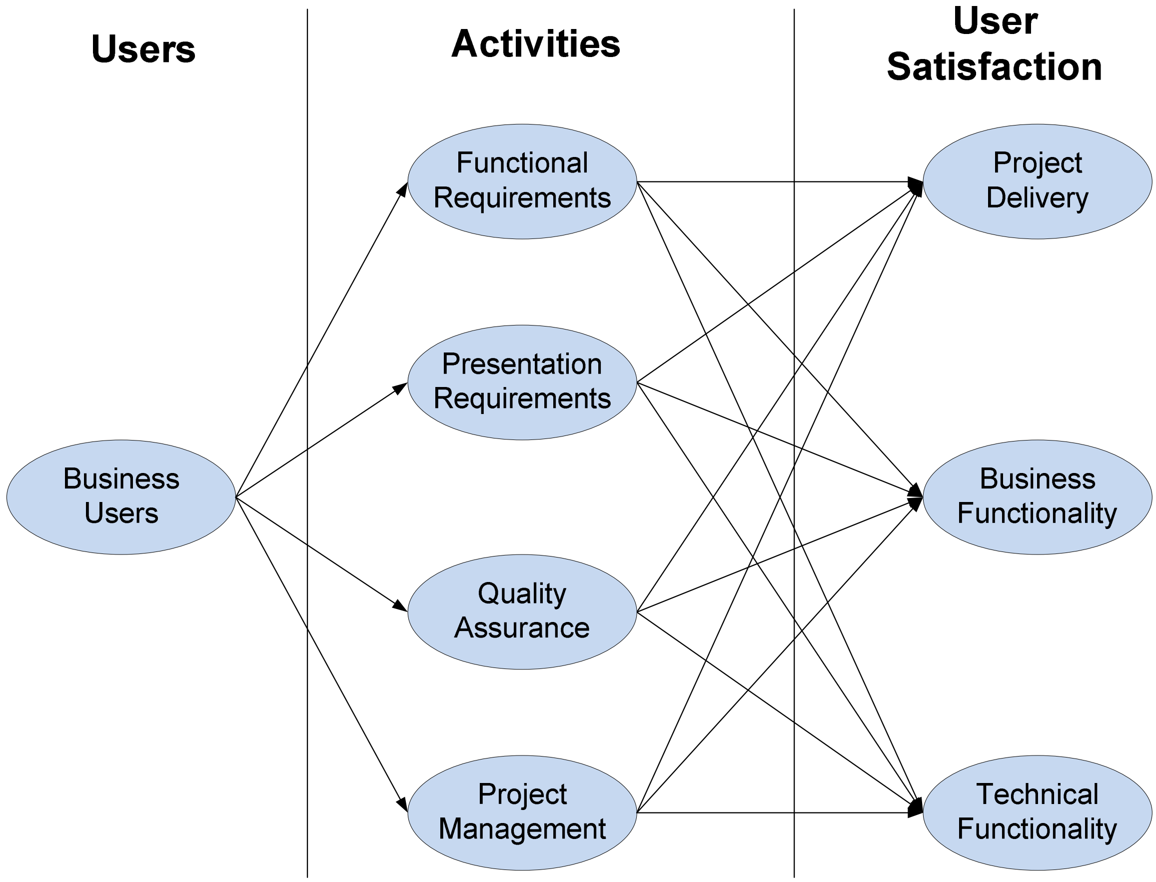
[16] Work Breakdown Structure is "a deliverable-oriented hierarchical decomposition of the work to be executed by the project team to accomplish the project objectives and create the required deliverables." (Project Management Institute, 2008, p. 452)

[17] Project schedule network diagram is "any schematic display of the logical relationships among the project schedule activities." (Project Management Institute, 2008, p. 444)

[18] One can reasonably infer aspects of sequential tasks in this paper's findings since generally accepted project management methodologies suggest that scope and requirements precede design, construction and test (Project Management Institute, 2008).

Figure 3: Multiple Factor User Satisfaction Model - Basic



V.2 Primary Constructs

The Multiple Factor User Satisfaction model contains eight constructs divided into three categories. This section describes each construct based on the literature reviewed.

V.2.1 Business User

The literature's diversity of sample sets inhibits the ability to generalize findings as being representative of the business user. In this study, we define the Business User as those people who are system users, their management, their support teams, the executive management, or professionals representing any one or more of these user groups, thereby excluding IS professionals and project managers.

We note that the Business User construct is in the MFUS model to statistically demonstrate the potential impact of a user's involvement on the four modeled activities, essentially reporting their covariances. It can alternatively be removed from the model since the sample frame is limited to people who self-reported themselves as business users[19].

V.2.2 Business User Activity

Table II summaries the four primary user activities undertaken by business users on IS projects; the MFUS model includes four constructs to represent these four activities.

V.2.2.1 Functional Requirements

International standard boards typically do not separate types of requirements although they may detail various attributes or dimensions of requirements. For example, ISO 9001 certification has no division between types of requirements as suggested in prior literature. Capability Maturity Model Integration (CMMI) Product and Service Development Requirements Development does not differentiate between types of requirements but does detail various attributes of requirements (Carnegie Mellon University, 2010). The Project Management Institute does not differentiate between types of requirements (Project Management Institute, 2008). The Guide to the Software Engineering Body of Knowledge (IEEE, 2012, Chapter 2) defines functional requirements (functions that the software is to execute) and non-functional requirements (requirements that tend to constrain the solution).

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[19] An alternative model was analyzed where the BU construct was replaced with the covariations between activities; no significant differences were identified.

We propose two separate constructs to represent the gathering of system requirements based on the literature: Functional Requirements and Presentation Requirements. Functional Requirements address the tactical business purpose of the information system and includes what data is to be used, the processes of collecting and validating the data, the data's security, the calculations that employ the data and the task and system complexity. We propose the manifest variables of process, calculations, data storage, security, and task complexity to describe the construct of Functional Requirements (see Table XXVI).

V.2.2.2 Presentation Requirements

The second requirements-related construct is based on the information system's human interface and established measures (see Table II). The primary users of an information system are concerned with its data, processes and calculations. The presentation (human interface) of the system is of some concern to them but the reports and ad hoc queries may be of greater concern to a different user community. Based on the literature, we propose manifest variables of forms, screens, reports, and queries to represent the construct of Presentation Requirements (see Table XXVII).

V.2.2.3 Quality Assurance

Hutcheson (2003) provides an approach to quality assurance. She advocates the creation and use of a test inventory ("the complete enumeration of all known tests; path, data module, design, system, and so on", ibid, p. 388) which is used to organize the test cases, execute the tests and determine test coverage ("the percentage of everything that could be tested that was actually tested", ibid, p. 388). Hutcheson (2003), Iacob and Constantinescu (2008) and Olalekan and Adenike (2008) recommend the use of quality assurance tools and methods to organize, document and report on the quality assurance progress as well as reducing time spent on repetitive tasks that modern tools can automate. Individual test cases should be written in such a way that they identify the test conditions, show traceability to the requirements, contain the expected result and are executable (Iacob and Constantinescu, 2008). The Project Management Institute (PMI) prescribes three processes within the Quality Knowledge Area: Plan Quality, Perform Quality Assurance, and Perform Quality Control. Plan Quality is the set of activities related to identifying and specifying the specific tests to perform; Perform Quality Assurance is the actual execution of the individual test cases to validate whether predefined quality standards are being used; and Perform Quality Control is the monitoring of quality progress and recommending necessary changes.

Light weight methodologies explicitly involve users for many activities as noted above, but additionally include users in the design and execution of system testing. Users may occasionally use the quality assurance tools but most often as reviewers and approvers due to the technical nature of these technically sophisticated tools.

Use of prototypes in IS projects is one technique that has been successfully used to improve software product quality (Tudhope et al, 2000; Khan et al, 2011). Kristensson et al (2008, p. 485) argue that users experiencing a prototype provide better ideas than “undifferentiated and directionless brain-storming activities”. Participatory design methodologies benefit from the use of prototypes by allowing teams to visualize future products and services (Cahill and McDonald, 2006). Campbell et al (2007, p. 633) find that functional prototypes enable analysis of all design criteria and “act as a catalyst for stimulation of further ideas and development”. Prototypes have become very popular because of their increasing ease of use; software development teams can typically create a prototype with little effort allowing the user to experience the system as it will appear when implemented in their production environments.

Therefore, we propose the user's involvement in test design and execution, use of quality assurance tools, and use of prototypes as manifest variables to define Quality Assurance (see Table XXVIII).

V.2.2.4 Project Management

Project Management is a well-studied construct. Franz and Robey (1986) note that UI in pre- and post-implementation periods contributed to a smooth implementation of an information system; Wagner and Newell (2007) find similar results related to post-implementation activities. Doll and Torkzadeh (1989), Kappelman and McLean (1991) and Kappelman and McLean (1992) also support UI during implementation phases of IS projects. Jiang et al (2002) note the positive impact of pre-partnering with vendors and consultants. Robey and Markus (1984) include a number of management and administrative activities in their study of user activities; these include preliminary surveys, feasibility studies, training, conversion, installation and operations. Somers and Nelson (2001) find that there are a number of management and administrative activities that positively influence project success including top management support, project champion, vendor/customer partnerships, project management, steering committee, human resource management (such as use of consultants and dedicated resources) and communication. Sridhar et al (2009) investigate the effect of UI in project planning and find a positive relationship. Light weight methodologies allow users to be involved wherever their domain knowledge and business connections may positively impact the project. Based on the literature, we propose that a business user's involvement during schedule development, problem solving, risk and conflict management, non-IS communication, and implementation as the manifest variables defining the project management of an IS project (see Table XXIX).

V.2.3 User Satisfaction Constructs

DeLone and McLean (1992) find that there is no direct measure for the success of an information system project. They then argue for the use of user satisfaction as being "especially appropriate when a specific information system was involved" (ibid, p. 68). Terry (2008, pp. 199-200) describes user satisfaction for business-to-consumer systems as being related to meeting requirements and usability. Ives et al (1983, pp. 785-786) provide a thorough description of the user satisfaction construct. They note that it is a "perceptual or subjective measure" that although in theory is defined by economics, the practical effect cannot be so easily measured. They create a 39 measure instrument for user satisfaction as well as a 13 measure "short form". This instrument was later confirmed by Baroudi and Orlikowski (1988). User satisfaction has been used as the dependent variable in empirical research models as a surrogate of project success and user involvement (Hsu et al, 2008; Doll and Torkzadeh, 1989; McKeen and Guimaraes, 1997; Ives et al, 1983). Specifically, Hsu et al (2008) notes that 18 of the 31 articles they reviewed employed "user satisfaction" as their dependent variable with various types of user participation as independent variables. Their analysis shows 15 studies indicating positive effects of participation, two indicating insignificant effects and one showing negative effects. Chen et al (2011) studies six factors related to project management performance comprising meeting project goals, completing the expected amount of work, achieving high quality, adherence to schedule, adherence to budget, and efficient task operations.

Information systems exist to benefit users and users are the primary people who can fully appreciate the value to be derived by their use. Given the recommendations from literature to have multiple measures of user satisfaction, the MFUS model engages three user satisfaction constructs detailed in the following sections.

V.2.3.1 Project Delivery

The Guide to the Project Management Body of Knowledge "PMBOK®" (Project Management Institute, 2008, p. 6) describes six factors necessary to achieve project success: scope, quality, schedule, budget, resources, and risk. Axiomatically, budget (cost), schedule and scope are considered to be the "triple constraints" of project management; i.e., one of these three dimensions cannot be changed without affecting one or both of the remaining two factors. The Chaos Report (PM Hut, 2009) also uses the concept of a "triple constraint" as the primary determinant of project success. Somers and Nelson (2001) identified these factors as being critical for ERP implementations. Martin, Pearson & Furumo (2007) describe these factors as being "widely accepted". Aladwani (2002) finds that task outcomes (as indicated by adherence to schedules, adherence to budgets and ability to meet its goals) are one set of valid indicators of user satisfaction in his integrated performance model. Nimudolu & Subramani (2004) include this construct (indicated by six measures) as their proxy for user satisfaction in their study of approaches to managing software development projects. Chen et al (2011) studied an IS project's ability to meet project goals, complete the expected amount of work, deliver high quality of work, adhere to the schedule, adhere to the budget, and perform tasks efficiently. Based on literature, we propose the use of cost, schedule, and scope to measure "Project Delivery" (see Table XXX).

V.2.3.2 Business Functionality

This construct focuses on traditional measures that originate from a user's perspective, such as system usage, timely delivery of services, accuracy of data, quality of product and service, financial benefits from system use, operational efficiencies and ease of use. Aladwani (2002) finds support for organizational outcome by testing whether the project added to business operations. Baroudi & Orlikowski (1988) measure business functionality using reliability of output information, relevancy of output to intended function, accuracy of output information, precision of output information, and completeness of output information. DeLone & Mclean (1992, p. 67) study information system success across the constructs of system and information quality, usage and user satisfaction. They later updated their model to document 24 measures of e-commerce systems success across system, information and service quality, usage, user satisfaction and net benefits (DeLone & Mclean, 2003, p. 26). Based on the literature, we propose measuring system usage, timely delivery of data, accurate data, system quality (output information being accurate, precise and complete), financial benefits, operational efficiencies, and ease of use as measures determining "Business Functionality" (see Table XXXI).

V.2.3.3 Technical Functionality

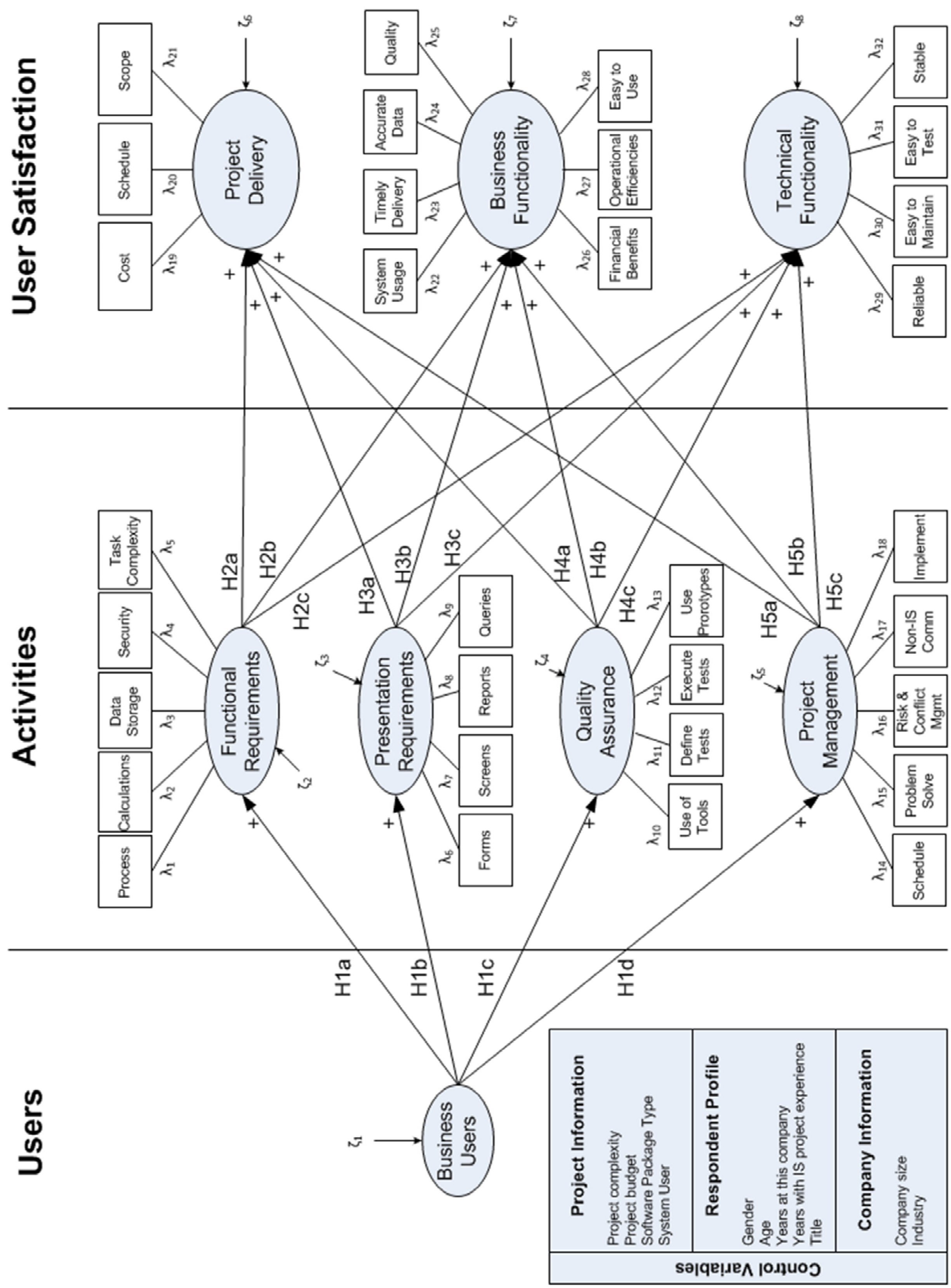
Information systems are inherently technical in nature and substance. This construct represents the various measures of technical performance such as reliability, ease of maintenance, ease of testing and stability. Bevan (2000, p. 4-5) documents the

ISO/IEC 9126-1 Software Product Quality Model that incorporate maintainability ("the capability of the software product to be modified … modifications may include corrections, improvements or adaptation of the software to changes in environment, and in requirements and functional specifications" which are measured by the system's analyzability, changeability, stability and testability) and portability ("the capability of the software product to be transferred from one environment to another" which are measured by the system's adaptability, installability, co-existence and replaceability). Therefore, based on literature, we propose reliability, ease of maintenance, ease of testing and stability as measures determining "Technical Functionality" (see Table XXXII).

V.3 Multiple Factor User Satisfaction Model

We propose the Multiple Factor User Satisfaction (MFUS) Model to describe the relationships between the eight previously defined constructs (Figure 4). The details of the hypotheses are provided in Section V.4; CHAPTER VI describes our approach to data collection, experiment design and structural equation modeling.

Figure 4: Multiple Factor User Satisfaction Model - Detail



V.4 Relationships between Constructs

Our research contributes to the literature by providing a more comprehensive model to describe User Satisfaction on IS projects. We simultaneously study multiple activities that business users can perform on IS projects. The MFUS model includes the unique division of business requirements into Functional and Presentation requirements. Multiple measures of User Satisfaction are included to analyze how business users perceive performance along these dimensions. This section documents the *a priori* relationships within the MFUS model to be empirically tested.

V.4.1 Business Users and Project Activities

Information Systems are created for the benefit of business users to help manage day-to-day operations and to assist with decision making processes. Since the systems exist to support the business users, it is the business users that must define the necessary functions and use. Standish Group (1999) states that when requirements are poorly defined or ad hoc, the end product is typically unsatisfactory. McKeen & Guimaraes (1997), Chen et al (2011), Kelly (2011), Huang & Kappelman (1996), Schummer et al (2006) and Krisstenson et al (2008) all support the value of UI in developing quality requirements. Sharma, Stone & Ekinci (2009, p. 40) note that developing high quality business requirements is the most critical activity on large projects. They divide requirements into multiple types such as functional and usability. The Institute of Electronic and Electrical Engineers (IEEE) recommended practice for software requirements specifications (IEEE, 1998, p. 3) identifies five issues that documentation should address: functional, external interfaces, performance, attributes and constraints. Information analysts may assist in the formal discovery and documentation of these requirements by any number of means, but the final goal of the discovery process is a complete set of business requirements. This research is not designed to address what requirements gathering methods, techniques or tools are used, but simply whether any requirements documentation processes are used. Therefore, based on the literature, we propose the following two hypotheses (see Figure 5):

H1a: Business users involved in IS projects positively impact the creation of functional requirement specifications.

H1b: Business users involved in IS projects positively impact the creation of presentation requirement specifications.

Software development is a very complex undertaking (Kitchenham, Pfleeger, Pickard, Jones, Hoaglin, Emam and Rosenberg, 2002; Tudhope et al, 2000; Philip et al, 2010). IS projects deemed to have moderate to high complexity were more likely to be abandoned (Ewusi-Mensah & Przasnyski, 1991). Zmud (1980) states that the "logical complexity [of a large software system] cannot be maintained in one person's mind". This complexity comes from the variety of infrastructure components, the number of interfaces and software components, the pace of change and the mere physical size of the project. Separate studies of enterprise resource planning systems by Somers and Nelson (2001) and Wang et al (2008) support Zmud (1980). McKeen and Guimaraes (1997) argue that software product complexity has two dimensions: task complexity (the steps and actions required by users) and system complexity (introduced by the components or methodology employed). Bostrom, Gupta & Thomas (2009) and Loebbecke and Powell (2009) argue that methodologies where a social-technical dimension is considered increase the complexity of the project.

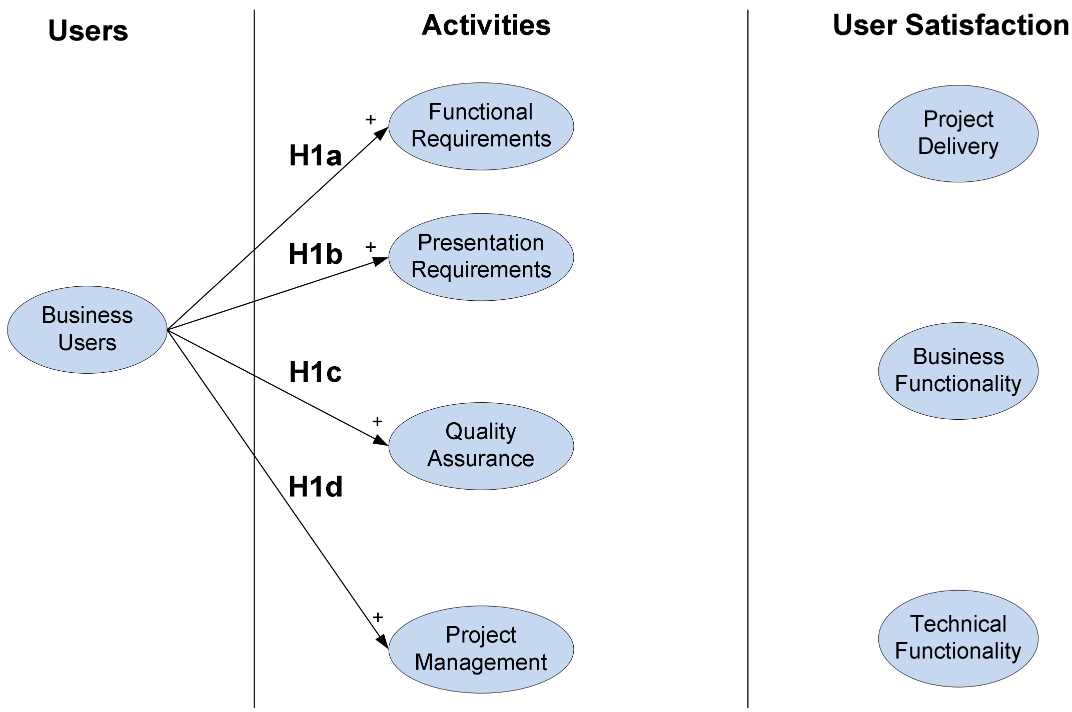
User involvement is important to the project's success because of the unique ability users have to extrapolate the system's functionality into their workplace. Their involvement testing the system, whether throughout the project life cycle or at the end of development, reduces the risk of deploying systems that will not meet the business requirements and ultimately reduce user satisfaction. Coombs et al (2001) note that every implementation of the software product they studied performed system testing and considered system testing to be a best practice. Damodaran (1996) specifically argues for user involvement throughout the quality assurance phase of a project. Based on the literature, we propose the following hypothesis (see Figure 5):

H1c: Business users involved in IS projects positively impact the project's quality assurance activities.

Managing information system projects is a complex activity that typically involves the use of a technologically oriented project manager. However, many of the decisions that must be made regarding the project's schedule, problem resolution, risk and conflict management and implementation is best done in consultation with the business user community. Robey and Markus (1984) describe user involvement in a number of management and administrative functions (such as steering committees and general communication) on ERP projects. Zmud (1980) also identifies the value from UI in steering committee, planning and control activities. Franz and Robey (1986) note the importance of user involvement both during the project and after deployment of the IS application. Barki and Hartwick (1994a) identify the benefit from UI in change management and project funding. Cowan et al (1992) argue for UI during pre-partnering as a part of the procurement activities. The literature corroborates integration, time, cost and communication knowledge areas in the Guide to PMBOK® (Project Management Institute, 2008). Additionally, communication to the non-technology community can be best performed by the business users given their familiarity with the context of the new system upon implementation. Based on the literature, we propose the following hypothesis (see Figure 5):

H1d: Business users involved in IS projects positively impact project management activities.

Figure 5: Hypothesis 1



V.4.2 Functional Requirements

The literature considers the discovery and documentation of business requirements to be a single activity. Chen et al (2011), Kelly (2011) and Huang and Kappelman (1996) document how user involvement positively impacts correct system specifications which enables relevant designs and provides users with a sense of ownership in the completed system. However, our literature review suggests that there are two separate types of requirements. This construct represents the first of these types of requirements.

As previously noted, functional requirements are characterized as those that define processes, calculations, data storage, security, and task complexity of the completed information system. The business user is the only person that understands the business needs for the new or enhanced information system. They can provide the details of what and how the system should function and perform. Any errors, omissions or ambiguity in the functional requirements will therefore have negative consequences on one or more of the project's scope, cost or schedule. Thus, we propose the following hypothesis (see Figure 6):

H2a: The creation of IS functional requirements positively impacts project delivery.

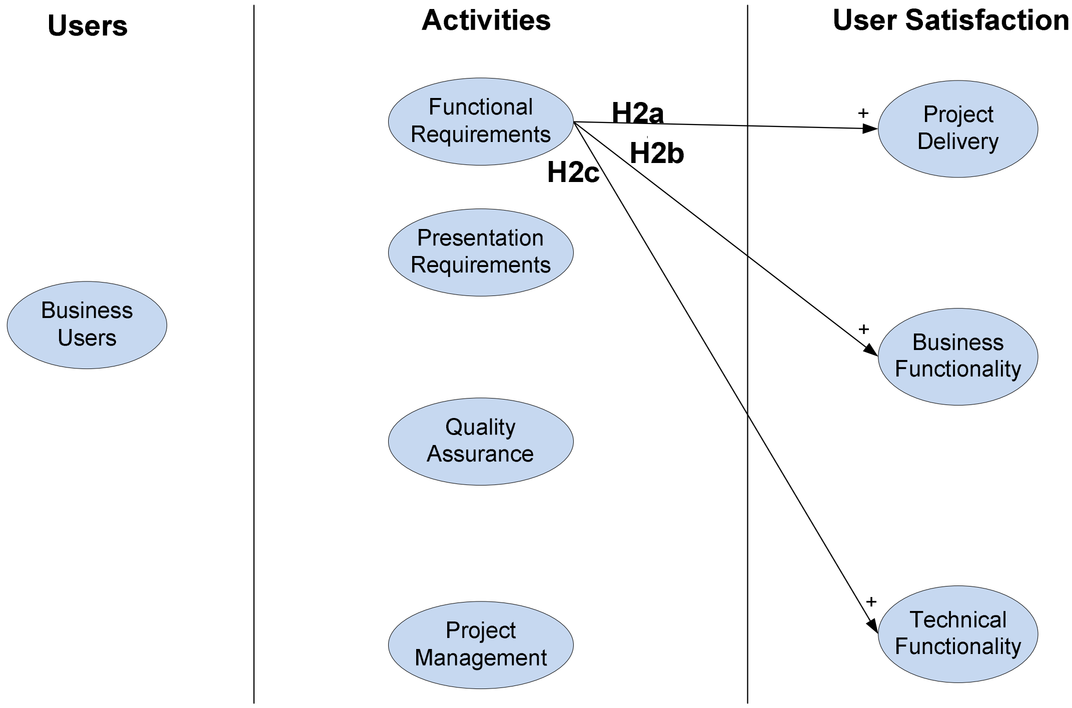
Business functionality, as defined for this research, encompasses system usage (users actually employing the IS system for the work tasks), timely delivery of results, accurate results, desired quality, desired benefits, improved operational efficiencies, and ease of use. A system designed with incorrect processes, inaccurate calculations, incomplete or delayed data storage and retrieval, incorrect or weak security, and overly complex user tasks will negatively impact business functionality. Therefore, since the business user is the best person to provide these requirements, we propose the following hypothesis (see Figure 6):

H2b: The creation of IS functional requirements positively impacts business functionality.

Technical functionality addresses the operational dimensions of an information system after it is deployed. For this research, these include the system's reliability, maintainability, testability and stability (Bevan, 2000). These are operationally important characteristics to business users. Processes that are incorrect or incomplete can negatively affect the stability of an operational system. Similarly, errors in calculations, data storage design, and security design can directly affect a system's reliability, maintainability, and testability. Although a business user may not comprehend the technical components, constraints and opportunities available within the organization, they can still provide the guidelines and constraints that the technical can use to configure the final environment. Therefore, we propose the following hypothesis (see Figure 6):

H2c: The creation of IS functional requirements positively impacts technical functionality.

Figure 6: Hypothesis 2



V.4.3 Presentation Requirements

As described in the previous section, presentation requirements (the IS requirements that document the data entry forms, display screens, reports, and user queries) are identified in the literature as separate activities from the definition of the other functional requirements. Business users will be the direct benefactors and users of the information system; they sequence and manner in which they interact with the system can be important to its efficient and effective use. If they do not provide clear direction, possibly examples, in a timely manner, there can be a negative impact on the information system project's scope, cost and schedule. Therefore we propose the following hypothesis (see Figure 7):

H3a: The creation of IS presentation requirements positively impacts project delivery.

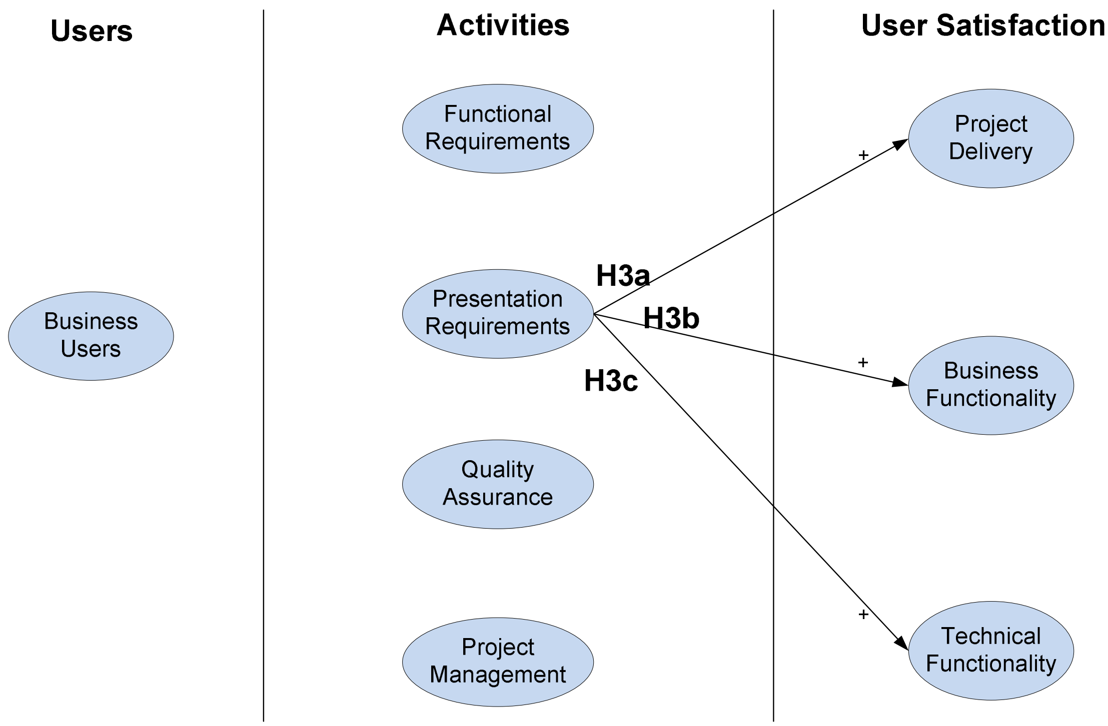
The various business functional measures of user satisfaction are particularly sensitive to the presentation requirements. For example: a system's ease of use is seriously affected by the design of its forms, screens and reports since they are the user's primary method of understanding and interacting with the data. A screen's ambiguity, or conversely its clarity, directly impacts the user's ability to enter data accurately or interpret the system's output correctly. Therefore, we propose the following hypothesis (see Figure 7):

H3b: The creation of IS presentation requirements positively impacts business functionality.

Since the presentation requirements are the primary method that business users interact with the information system, its clarity (or ambiguity) directly affects the system once implemented. If these features are not well understood by users or technicians, the system's technical functionality can be compromised. The specific requirements they provide may force an implementation that is difficult to support, or may leverage capabilities of the technical environment that helps both the user and technical communities. Therefore, we propose the following hypothesis (see Figure 7):

H3c: The creation of IS presentation requirements positively impacts technical functionality.

Figure 7: Hypothesis 3



V.4.4 Quality Assurance

IS quality assurance activities have received significant attention in research. Given the inherent complexity of modern software development projects, quality assurance activities become critical to their successful completion. The project's schedule and cost should experience fewer variations due to special cause variation being reduced as the quality assurance activities increase. The quality assurance activities are typically designed to include the testing of conformance to project scope in an effort to deliver the expected functionality and benefits. Business users provide a unique perspective since they comprehend the implications of erroneous process flows or calculations. Their involvement validating critical functions can reduce the implementation and performance risk of the project. Therefore, we propose the following hypothesis (see Figure 8):

H4a: The performance of quality assurance activities positively impact project delivery.

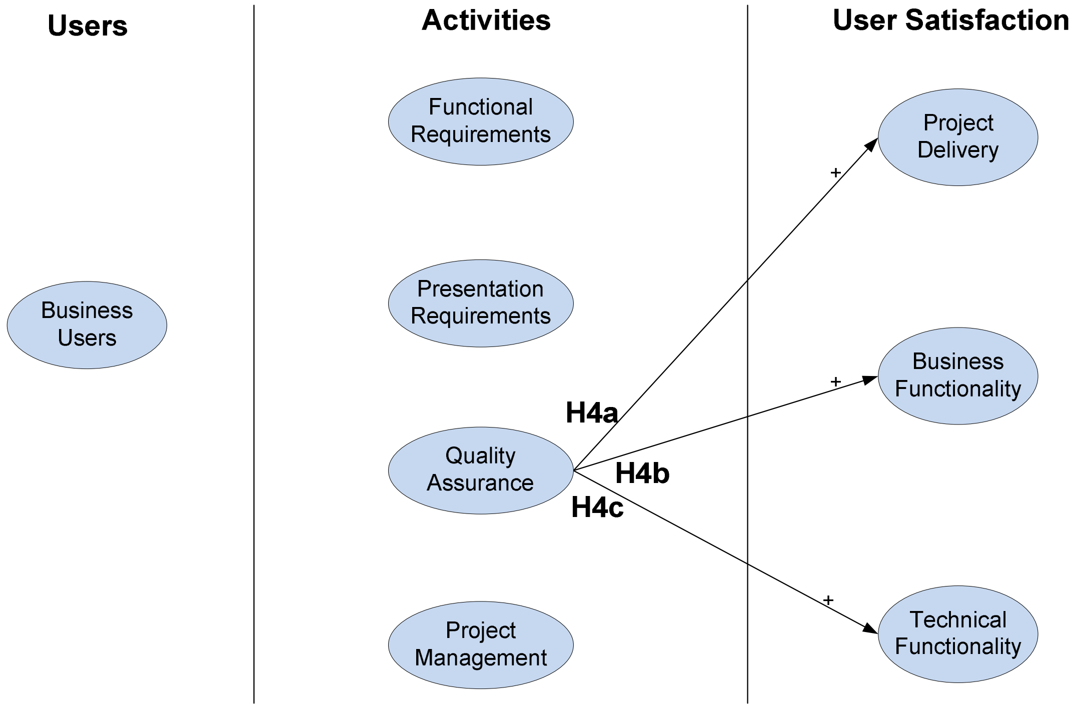
Business functionality defines user satisfaction in terms of timely delivery, accurate data, financial benefits, operational efficiency, and ease of use. These are attributes of a system that should be specified in the requirements and therefore can be tested within the quality assurance tasks. The IS project team can assemble professional quality assurance members to use the requirements documents to design and execute the necessary tasks, but business user involvement on the quality assurance tasks will significantly improve results (since they can immediately resolve or interpret ambiguous test results) and address the prioritization of subsequent activities to address discovered software issues. Therefore, we propose the following hypothesis (see Figure 8):

H4b: The performance of quality assurance activities positively impact business functionality.

Complete business requirements will include system attributes of reliability, maintainability, testability, and stability. These are included to help the IS team develop or procure non-functional design components that help achieve these features. As a result, the quality assurance tasks should then include specific tests to ascertain compliance to these requirements. The business user's participation with these quality assurance tasks can clarify questions as they arise during the test design process and quickly prioritize the remediation tasks given any observed variance from the desired specifications. Therefore, we propose the following hypothesis (see Figure 8):

H4c: The performance of quality assurance activities positively impact technical functionality.

Figure 8: Hypothesis 4



V.4.5 Project Management

Project Management is often regarded as a set of nine knowledge areas or sets of tasks (integration, scope, time, cost, quality, human resources, communication, risk, and procurement) that can be applied to any project to help deliver the intended results as specified (Project Management Institute, 2008). The available project management literature has identified five areas that could involve business users and have a positive impact to the project success: schedule, problem solving, risk and conflict management, non-IS communication, and implementation. Business users can add value to the management of an IS project by helping give the business perspective to the project manager. Their activities will positively impact the system's scope, cost and schedule since they have the effect of reducing variation within those measures. Based on the literature, we propose the following hypothesis (see Figure 9):

H5a: The execution of project management activities positively impacts project delivery.

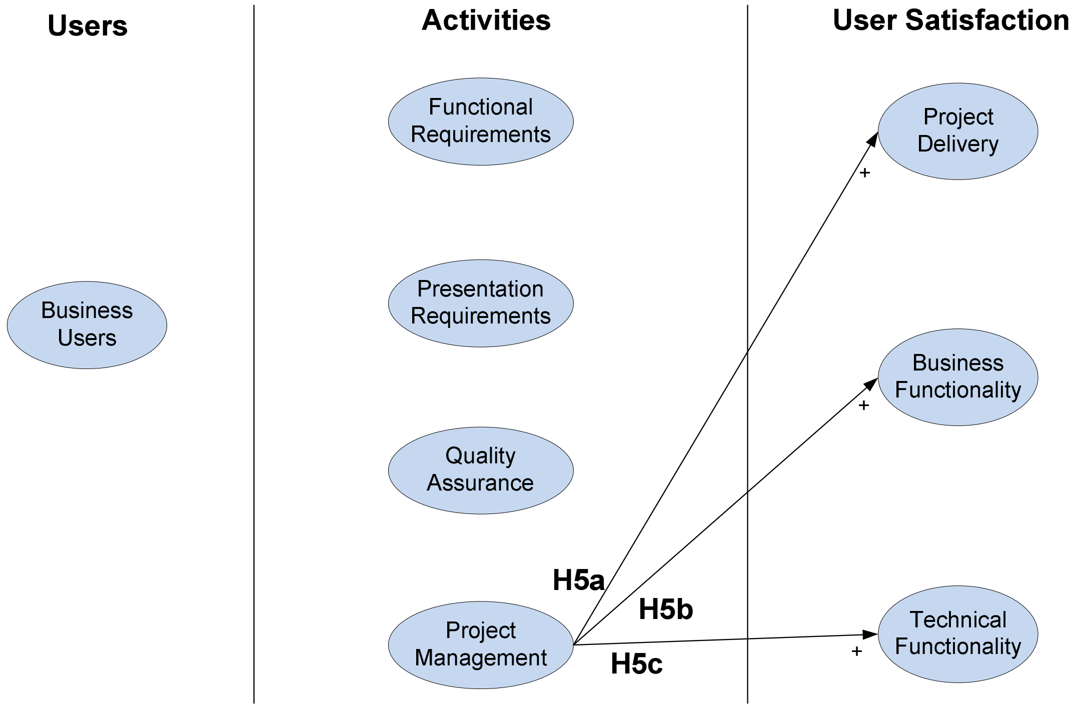
Business users seek new or improved information systems to improve their operational capabilities; i.e., they desire the new system to have the characteristics associated with the Business Functionality construct. Ensuring communication with non-IS team staff, managing risk and conflicts, solving problems, addressing schedule changes, and assisting with implementing the system are key activities that reduce the risk of variances between the business user's expectations and the final delivered system. Therefore, we propose the following hypothesis (see Figure 9):

H5b: The execution of project management activities positively impacts business functionality.

Modern information systems are complex integrations of hardware, networks, security systems, operating systems, and the specific business application. The technical functionality is critical to the user experience once deployed into their production environment. A business user's involvement on these selected tasks can reduce the project's implementation risk. Each measure will positively affect the technical functionality if performed well. Therefore we propose the following hypothesis (see Figure 9):

H5c: The execution of project management activities positively impacts technical functionality.

Figure 9: Hypothesis 5



CHAPTER VI

METHODOLOGY

This section presents the solution approach to be used; i.e., the method and analyses to answer the research questions using the MFUS model discussed in the preceding section. This section begins with a description of the empirical experiment's design followed by how the sampling was performed, the specific analyses that were executed and the mathematical foundation describing the relationships within the MFUS model.

VI.1 Experiment Design

VI.1.1 Methodology

This research is designed to be empirical, i.e., "knowledge based on real world observations or experiment" (Flynn, Sakakibara, Schroeder, Bates and Flynn, 1990, p. 251). The data collection method is a single questionnaire which was pre-tested before being sent to the full sample set.

VI.1.2 Survey Instrument

Empirical research is effective at verifying models and relationships. There are a number of methods available to the researcher with the most common being interviews, Delphi technique, mailings, electronic surveys, telephone surveys, and subject matter experts with surveys (postal, electronic or telephone). This research used electronic and paper surveys to obtain responses for analysis of the Multiple Factor User Satisfaction Model. The cover letter identifies the desired respondent and the purpose of the survey, guarantees anonymity, provides contact information of the researcher and includes a request to forward the survey to an appropriate person in their company if the recipient does not qualify for the purposes of this research.

In early 2013, the proposed survey instrument and cover letter were sent to 17 professionals and academics familiar with the domain of IS projects. The proposed instrument was also reviewed by an academician for purposes of survey validation given their early work in that field. Flynn et al (1990) states that the two-fold purpose of a pre-test is to determine whether the questionnaire is easy to complete by the intended sample set and which concepts are either unclear or unable to be answered by the respondent because they do not have those responsibilities or knowledge. The survey instrument and its cover letter were improved based on the feedback received to indicate the estimated time to complete, document the requirements for the survey respondent's eligibility, improve the clarity of measurement definitions, and standardize verb tenses. The development of the questionnaire from the literature and revising it based on feedback from the pre-test provide content validity. The final cover letter and survey instrument are shown in Appendices 1 and 2 respectively.

VI.1.3 Measurement Scales

The specific measures are discussed in Section V.2. All measures implemented in the survey instrument employ a 7-point Likert scale (following Dvir, 2005 and Ravichandran, 2000). This allows for a more granular analysis of these measures than a

5-point scale without providing the respondent with too many choices that larger Likert scales provide (Barki, Titah and Boffo, 2007). The consistent use of a 7-point scale for all measures reduces confusion for the respondent regarding how to answer the question and maximizes the statistical variability between respondents. The odd number of choices on the scale is specifically selected to allow the respondent to indicate a neutral response without leaving the item blank. Care was taken to have no reverse scored scales to reduce respondent errors which would reduce the instrument's validity. Further, the questions are worded so that a business user or practitioner would logically recognize the questions (confirmed during the pre-test), thereby increasing their ease of completion and reducing the time to complete the survey.

VI.1.4 Control Variables

We use eleven control variables found in the literature that are divided into three groups for this research. These control variables serve two purposes. First, they can be used to describe the survey participants. Second, they will be used to explore the survey results to improve our understanding of the relationships in the model.

VI.1.4.1 Project Information

Project information is represented by a set of four control variables. Information system projects are often complex endeavors since there are large numbers of possible technologies and human design factors. More complex projects require a greater level of attention due to their increased level of risk. We provided a system complexity variable to represent the user's perception of the project's complexity (Martin et al, 2007). The size of a project in dollars can affect the number of users involved on the project and their level of involvement (Martin et al, 2007; Dekleva, 1992). We include a control variable to capture the project budget to address this potential impact. Practitioners frequently perform a "make or buy" analysis before beginning most IS projects to determine the availability and applicability of commercially available software packages. There are times when a commercial package may provide the primary business functions but then must have additional functionality provided by custom developing modifications or additions to that package. We include a control variable for whether the project involves the implementation of a commercial package software system, completely developed "in-house" to custom specifications, or is a combination of a commercial package with custom development. Literature suggests that the primary intended user of the information system may impact the development process or perceived results of the project. Therefore a fourth control variable represents whether the primary users of the system are internal company employees and agents, or customers, or a combination of both.

VI.1.4.2 Respondent Profile

Five variables are identified to characterize the respondent's demographics. Capturing and reporting demographic data of the respondents helps identify and categorize them which may lead to possible insights regarding the model performance. Typical demographic data for a respondent includes their gender, age range, years at that company, and years with IS project experience[20] (Chen et al, 2011). Our questionnaire includes all four of those variables. We include one additional control variable to capture

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[20] "Years with IS experience" is not to be confused with an IS professional; this variable measures the business user's years of experience using information systems as part of their job responsibilities.

the user's title to serve as a proxy for their role on the project: non-management, middle management, executive management, or supportive role (such as finance or human resources).

VI.1.4.3 Company Information

Company size, as measured by the number of employees, is frequently used as a control variable in empirical studies (Shin, Collier and Wilson, 2000; Jiang and Klein, 2000; Flynn et al, 1990; Nidumolu and Subramani, 2004; and Sioukas, 1994). It can determine whether there are differences in outcomes or relationships based on stratification of the reported company sizes. An industry can have a significant impact on a company's processes, constraints, opportunities and technologies; it is often included as a control variable to explore potential differences between results (Chen et al, 2011). Therefore, we include these two control variables, company size and industry, to capture basic company information for analysis.

VI.2 Sampling Plan

VI.2.1 Unit of Analysis

The literature utilizing empirical methods to study user satisfaction predominantly surveys the IS professional or the project manager; yet business users are infrequently surveyed or the sample frame has been limited to specific industries. Business users are the people with direct knowledge of their business function and the impact that the information system will have on those business functions (see Table I). We believe that the business user has a different perspective on the activities they are involved in along with their perception of satisfaction. Therefore, we define the Business User as a non-IS business person that either uses the system as part of their regular work routines, oversees employees that regularly use the system, or the business analyst that liaisons between the business users and the technical design and development team.

VI.2.2 Sample Set

This research recognizes the importance and criticality of the business user to the delivery of business systems. Therefore, the sample set for this empirical research is exclusively the business user to ensure that the findings represent business users. It was not constrained to any one or more industries for the purpose of obtaining a cross industry sample to improve the generality of the findings while simultaneously increasing sample size to improve statistical significance.

The sample set of business users was randomly generated from two sources: Professional Organizations with U.S. chapters such as the International Institute of Business Analysts (IIBA) and the Project Management Institute (PMI), and a purchased list of business managers from Hoovers, Inc. The Hoovers' list was filtered to business users within the United States and to job categories most likely to generate appropriate survey respondents (business managers, analysts, executives, and consultants, while excluding employees not regularly using information systems as a primary part of their daily duties).

VI.2.3 Data Collection and Preparation

The primary tool for distributing and collecting the survey instruments was an online survey tool, Survey Monkey (www.surveymonkey.com). This tool performs the actual email distribution of the survey instrument to uniquely identified candidates, tracks who has been sent a survey, who has completed a survey (whether partial or complete), allows for reminder emails to candidates who have not yet replied to the survey, data analytics for submitted surveys, and downloads of the detailed survey submissions (i.e., a file of all submitted surveys). The survey instrument was also available in paper form for those who preferred to complete the survey manually. Such submissions were transcribed into the same format as generated by Survey Monkey's download so that these two sources of data could be electronically merged for detailed analysis. Although the original data could have been edited prior to being input to the statistical analysis tool, we choose to have all necessary editing be performed using the statistical analysis tool, if possible, to generate an audit of the data preparation steps.

VI.3 Analysis Approach

VI.3.1 Path Analysis with Latent Variables

Sound empirical research needs to demonstrate credibility and usability; this will be accomplished by a thorough analysis of the survey data (Flynn et al, 1994). We use confirmatory factor analysis (Hatcher, 1994) as a guide for the necessary reliability and validity tests. The author recommends following Anderson and Gerbing's (1988) two-step approach (Hatcher, 1994, p. 251). The first step is used to develop an acceptable measurement model – i.e., a model without causal relationships but one that demonstrates reliability, validity, goodness of fit, and significant factor loadings while minimizing the variance of residuals. This step also analyzes whether there are extraneous variables that can be considered for removal from the model, and considers what covariance relationships could be added to the model to improve the Chi-square measure. The second step begins by using the measurement model developed in the first step and adding the hypothesized causal paths between constructs thereby creating the hypothesized model of interest. The goodness of fit and residual variances are tested to determine whether this new combined model provides an acceptable fit to the data. Finally, the individual paths are investigated to determine what hypothesized relationships are supported, not supported or inconclusive.

VI.3.2 Unidimensionality

Unidimensionality is the condition where a set of indicators (manifest variables) represents a single hypothetical construct (latent variable). Manifest variables are variables that can be directly observed and measured whereas latent variables cannot be directly observed. Therefore latent variables are modeled so that a set of manifest variables describe the latent variable (Hatcher, 1994, p. 252). A confirmatory factor analysis is used to validate that the selected manifest variables do load onto the associated latent variable; this should be demonstrated before reliability and validity analyses can proceed (Ravichandran and Rai, 2000). Two conditions are necessary for establishing unidimensionality: the construct must be significantly correlated with the modeled representation of that construct as demonstrated by the empirical data, and that data can only be related to one construct (Hair et al, 2010). Since this analysis seeks to confirm that the designated set of measures does not represent more than one factor, the purpose of this effort is to document the absence of artificial correlations between the various model constructs. Anderson and Gerbing (1982, p. 453-454) state that a "lack of unidimensionality most often represents a measurement model misspecification" which would require that the model be respecified. We determine unidimensionality through Confirmatory Factor Analysis performed within Structural Equation Modeling (Gerbing and Anderson, 1988; Hair et al, 2010). Hatcher (1994) and Marsh et al (2004) state that the adequacy of a model should be determined using multiple statistical tests and indices. Table XIII lists the acceptable fit criteria for this study:

Table XIII: Goodness of Fit metrics

Statistic	**Target Value ***
Ratio of Chi-Square statistic to degrees for freedom	< 2.0
Standardized Root Mean Square Residual (SRMSR)	< 0.08
Parsimonious Goodness of Fit Index (GFI)	> 0.60
CFI (Bentler comparative fit index)	> 0.90
NNFI (Bentler and Bonnet non-normed fit index)	> 0.90
|Residuals| < 2.0	Yes
Symmetrical	Yes

* Hatcher, 1994

VI.3.3 Validity

VI.3.3.1 Content validity

Content validity is the extent to which the data measures the concept that it was intended to measure (Churchill, 1979). It is a subjective or judgmental evaluation that can only be achieved by experts and a reference to the literature (Emory, 1980; Flynn et al, 1994). The literature review section documented earlier found 42 theoretical studies (Table VIII and Table IX) and 89 empirical studies (Table X and Table XI) that identify critical independent variables and relationships that have been shown to support one or more of the dependent outcomes in this research.

VI.3.3.2 Construct validity

Construct validity is a determination of whether the measures are an appropriate definition of the construct (Carmines and Zeller, 1979). This is often necessary because manifest variables are used to identify the latent variables in structural equations.

Therefore, if structural relationships are to be identified and confirmed, the latent variables must reflect their intended purpose as measured by its manifest variables. Confirmatory factor analysis is used to confirm relationships as a process of determining convergent and discriminant validity. Convergent validity measures the construct's theoretical essence (tested with exploratory factor analysis, or EFA, and confirmatory factor analysis, or CFA) while discriminant validity measures the extent to which one measure does not contribute significantly to one or more other factors (tested by the chi-square of differences during CFA).

VI.3.4 Reliability

The reliability of a study is the measure of its ability to yield the same results if administered repeatedly to the same set of respondents. Unreliable results imply that the overall results of the study itself cannot be of value. Internal reliability is the primary test for this single questionnaire form of a survey. This can be measured by splitting the response set into two subsets and investigating the correlation between the two sets; a high correlation indicates internal consistency. The Cronbach's alpha test is the primary tool for this purpose (Cronbach and Meehl, 1955). The coefficient α is defined as the proportion of a scale's total variance attributable to a common source (Carr and Pearson, 1999).

Hatcher (1994) discusses the use of confirmatory factor analysis for determining indicator reliability and composite reliability. This analysis technique presumes an *a priori* relationship between the manifest (observable) variables and the latent variable which is the case for the measurement models within structural equations. Both the Cronbach's alpha and confirmatory factor analysis are routinely incorporated in common statistical analysis packages. We use both Cronbach's alpha and confirmatory factor analysis to determine the reliability of the measures in our model.

VI.3.5 Non-Response Bias

People who received the survey instrument but chose to not respond may not have responded for a variety of reasons. The dilemma of survey research is whether the non-respondents have different characterizations of the research model that would cause the survey results to be altered. There is little detailed data to determine whether they are indeed different from those who did respond. A common approach to this analysis is to divide all available surveys into two sets: those who responded quickly and those who responded only after being reminded (Lambert and Harrington, 1990; Armstrong and Overton, 1977). The analysis technique used in this research is a *t*-test to determine whether significant differences exist between the two sets of surveys (early and late respondents) at a 99% confidence level.

VI.3.6 Common Method Bias

Common method bias, also known as common method variance (Lindell and Whitney, 2001), is the "variance that is attributable to the measurement method rather than to the constructs the measures represent" (Podsakoff et al, 2003). Empirical survey instruments lend themselves to this class of error, since both the independent and dependent variables are often obtained from the same person concurrently. There are three ex-poste techniques to estimate this bias. The Harman Single Factor technique uses exploratory factor analysis where all variables are loaded onto a single factor and constrain the analysis so that there is no rotation (Podsakoff et al, 2003). If the newly introduced common latent factor explains more than 50% of the variance, then we have common method bias. Another technique is the Common Latent Factor (CLF) technique which introduces a new latent variable in such a way that all manifest variables are related to it, those paths are constrained to be equal and the variance of the common factor is constrained to be 1. The common variance is then the square of the common factor of each path before standardization. The third technique is often referred to as the common marker variable because it uses partial correlation and a marker, or presumed uncorrelated variable, to calculate the common variance (Lindell and Whitney, 2001). Our analyses include all three techniques.

VI.4 Structural Equation Modeling

Shah and Goldstein (2006) state that the process of using Structured Equation Modeling (SEM) for model confirmation involves determining the model's goodness of fit to the data along three dimensions: the overall model (using a continuum of fit measures), the measurement model (using both the constructs' reliability and validity, and an analysis of individual parameter estimates), and the structural model (using the sign, magnitude and significance of the path estimates). The authors urge researchers to use multiple measures of fit to ensure a quality interpretation of the data.

One of the primary strengths of SEM analysis is the ability to respecify the model for further analysis. Joreskog and Sorbom (1996) document three approaches for model specification. The first is the use of a single *a priori* model studied through confirmatory analysis; this has the limitation of providing no alternatives should the data not fit the model. The second is the use of computer generated models, but this runs the risk of finding models that have low validity or not finding better models at all. The third approach is to specify multiple *a priori* models for analysis. This has the advantage of using the literature (theory and empirical findings) to generate sound models for analysis. We use this third approach to reduce the "confirmation bias" of a researcher as recommended by Shah and Goldstein (2006).

VI.4.1 Definition

SEM was introduced in the early 20th century to model linear systems with latent variables. SEM has become a popular modeling technique when one or more of the constructs being investigated (independent or dependent) cannot be directly measured (Shah and Goldstein, 2006, p. 148). The SEM model is an *a priori* hypothesis about a pattern of linear relationships among a set of observed and unobserved variables (Shah and Goldstein, 2006, p. 149). Iacobucci (2010, p. 95) characterizes structured equation models as being "natural progressions from factor analysis and regression". Lattin, Carroll and Green (2003, p. 355) note that the technique "reflect[s] both the analysis of interdependence (i.e., measurement equations that relate the observed measures X and Y to the unobservable factors) and the analysis of dependence (i.e., the structural equations that describe the dependence relationships among the unobservable factors)". They further document that it provides goodness of fit calculations, i.e. the adequacy of the model to represent the observed data (ibid, p. 360). Kline (2005, p. 9) describes SEM as not designating "a single statistical technique but instead refers to a family of related procedures". Kline identifies seven characteristics of SEM models (ibid, pp. 9-16):

1. SEM is *a priori* – significant information must be provided by the model such as which variables are assumed to affect other variables along with the direction of their influence

2. Observed and Latent variables – SEM allows for modeling of more abstract hypotheses where directly measurable observations are not necessarily available
3. Covariances and Means – these convey greater information than standard correlations
4. Useful for nonexperimental and experimental data
5. Incorporates many statistical procedures since SEM techniques are a superset of the general linear model which include ANOVA, MANOVA and multiple regression
6. SEM is a large-sample technique due to the complexity of the model and the related need to reduce errors by having larger sample sizes
7. Statistical tests will vary because SEM techniques evaluate the entire model and the larger sample sizes may indicate highly significant results for trivial impacts

VI.4.2 Analysis Steps

Any statistical model has to be applied properly to generate benefits. SEM and other standard modeling approaches offer statistical tests of causality, but SEM provides necessary but not sufficient evidence of causality because of its evaluation of association. Additionally, Shook, Ketchen, Hult and Kacmar (2004) note the importance of testing the normality of univariate data since it is foundational to the model's validity. They further note the importance of testing reliability and validity. Kitchenham et al (2002, p. 729) provide specific analyses to perform sensitivity analyses, validate data assumptions, and apply quality control procedures. Shah and Goldstein (2006) point out a number of issues to be addressed to improve the reliability and validity of applying structural equation models including issues related to pre-analysis (conceptual issues, sample size, degrees of freedom and model identification, measurement model specification, and latent model specification), data analysis (data screening, type of input matrix, and estimation method), and post-analysis (evaluation of solution and model respecification). They suggest three recommendations for improved use of SEM in research. First, since researchers continue to debate the use of concurrently measured variables to infer causality, research papers should detail the theory, model, tests and expected results prior to performing the analysis. Second, research should be conservative with their statements of general applicability given the typically small sample sizes, extrapolation to the larger sample population, and selection of measurement items. Finally, identify and document biases toward the particular model being investigated. The mitigation is to generate multiple alternate, equivalent models *a priori* and described their findings.

Kline (ibid, pp. 63-65) lists six iterative steps for proper analysis using SEM:

1. Specify the model (see Hatcher, 1994, p. 345-346, for a description of the two components in a combined model)
2. Determine whether the model is identified[21]
3. Select measures for the variables
4. Estimate the model
5. Respecify the model to improve the model's fit to the data

[21] Kline (2005, p. 105) "A model is said to be identified if it is theoretically possible to derive a unique estimate of each parameter."

6. Accurately and completely describe the analysis in written reports

VI.4.3 Comparison to other methods

Lattin et al (2003, p. 352) describe SEM as a more general approach than canonical correlation that explicitly allows for measurement errors. Bowen and Guo (2012, p. 5) say that SEM can be "viewed as a general model of many commonly employed statistical models, such as analysis of variance, analysis of covariance, multiple regression, factor analysis, path analysis, econometric models of simultaneous equation and nonrecursive modeling, multilevel modeling, and latent growth curve modeling". They also note that the generality of the method and the need for multiple independent variables to represent one latent variable drives the researcher towards large sample sizes to maintain statistical reliability (ibid, p. 8-9). Shah and Goldstein (2006, p. 149) note that covariance structure modeling (CSM) "represents a general class of models that include ARMA (autoregressive and moving average) time series models, multiplicative models for multi-faceted data, circumplex models[22], as well as all SEM models" and therefore SEM can be seen as a subset of CSM. Structural equation models specify, estimate and evaluate linear relationships among observed variables in terms of a smaller set of unobserved (latent) variables. There are two subsets of SEM that are also of value in particular situations: Path Analysis and Confirmatory Factor Analysis. Path Analysis tests directional relationships between constructs when the measurable or manifest variables

[22] Olson (2000) defines a circumplex model as one focusing on the three central dimensions of marital and family systems: cohesion, flexibility and communication; i.e., this is a specific model from family psychology where SEM methods can be applied.

are known; the latent variables are the error terms. Confirmatory Factor Analysis is used when the manifest variables describing latent variables are pre-specified typically by restricting manifest variables to load on specific latent variables.

Partial Least Squares (PLS) is a technique that provides similar results with differing requirements and specifications. Hair, Black, Babin and Anderson (2010) provide a comparison of PLS and SEM. PLS focuses on predicting constructs rather than explaining the relationships between items; its goal is to produce parameter estimates that maximize the explained variance (ibid, p. 760). SEM focuses on how well the data supports a given model of relationships. The advantages for using PLS include relaxing the requirement for multiple measurements for any given latent variable, the ability to handle large models more easily than SEM, and relative insensitivity to sample size. One significant disadvantage is PLS' focus on prediction rather than model confirmation; specifically, PLS may estimate loading values that are in an acceptable range while the latent construct may not, in fact, be valid.

VI.4.4 Mathematical Representation

VI.4.4.1 General Form

SEMs express the dependence relationship between the dependent (exogenous) latent variables (η) and the independent (endogenous) variables (ξ) with an error term (ζ). Lattin et al (2003, p. 357) describe the general form of the set of equations as being analogous to a simple regression model with no intercept term since the observed covariance matrix is used to represent the model parameters. The structural equation model has two components: a measurement model and a structural model (for the detailed mathematical representations, refer to Appendix 3.1 for the Measurement Model and Appendix 3.2 for the Structural Model).

VI.4.4.2 Partially Latent Structural Regression

Structured equation models have significant benefits for modeling relationships with latent constructs; however, some research models may have one or more "constructs" that are directly observable (i.e., manifest variables). Kline (2005) describes this scenario as a "partially latent structural regression" model because it has one or more "single indicators". The author suggests that the variance can be calculated rather than estimated. Hatcher (1994, pp. 422-430) also describes this "nonstandard" model and gives an example along with its solution.

VI.4.4.3 Specific Form

The manifest variables being used to represent latent variables must be properly identified so the correlation matrices accurately represent the measurement model. Additionally, the structural constructs and coefficients must be accurately identified. The parameters providing the size of each matrix for the MFUS model are given here:

p (error variables) = 32

m (independent structural constructs) = 5

q (structural coefficients) = 32

n (dependent structural constructs) = 3

The combined list of variables including a cross reference between the mathematical model and the SAS implementation is given in Appendix 3.3.

VI.4.4.4 Sufficient Identification

For SEM to generate a mathematical solution the model must be "overidentified"; that is there must be more linearly independent equations than unknowns (Asher, 1988). If this is not the case, i.e., the model is underidentified, then there can be an infinite number of solutions. Hatcher (1994, 162-163) suggests comparing whether the number of data points is greater than the number of parameters to be estimated to determine whether a model is overidentified. We find that the theoretical MFUS model is overidentified as shown below and in the SAS output for the theoretical model:

- Number of data points: (p) (p+1) / 2 = 32 * 33 / 2 = 528
- Number of parameters to be estimated:
  Path coefficients + variances[23] + covariances
  = 16 + (33 + 7 + 24) + 0 = 80

VI.4.5 Application

The SEM technique is frequently used to test the dependence between constructs that are not directly observable. It also allows for the variables to have errors terms. This provides analytical value since many applications do not have directly observable variables or can be measured without error. User satisfaction is a latent variable since there is no single observation that fully describes it, which suggests the use of structural equation modeling for this research.

SEM has been used in prior operations management and IS research efforts. Recently, academic journals are specifying a minimum set of analyses to be performed as documentation that the SEM was applied correctly and that the results are understood

[23] Where variances = manifest variable error terms + latent variable error terms + manifest variable coefficient error terms

appropriately (Gefen, Rigdon and Straub, 2011; Chang, Witteloostuijn, and Eden, 2010). This research employs the common techniques in their recommendations.

VI.4.6 Sample Size

Structured equation modeling is a large-sample technique because these tend to be relatively complex models which have more degrees of freedom (Kline, 2005, p. 14). The type of estimation algorithm used can also impact the sample size requirements. The author states that sample sizes under 100 are small; 100-200 are medium and above 200 are large (ibid, 110). Small sample sizes will limit the power of various statistical tests. Hatcher (1994, pp. 73, 149) also says that this is a large-sample procedure and recommends at least 200 observations in any sample and recommends at least 5 observations for each parameter (where the parameters are defined as path coefficients, variances and covariances to be estimated).

The Multiple Factor User Satisfaction Model includes 32 manifest variables representing the 8 constructs. We calculate the need for an absolute minimum of 160 valid responses to have sufficient statistical validity; however since both Kline (2005) and Hatcher (1994) indicate that 200 observations are necessary before the sample can be considered sufficient, we will use 200 as the minimum target for valid observations. We now assume that there will be a response rate of 15% and of those that respond, only 80% of those observations will be deemed useful due to missing data or other data quality issues. Therefore, we will need to circulate a minimum of 1,667 survey instruments to obtain the desired number of useable responses.

VI.4.7 Computational Tool

SAS Institute, Inc. markets SAS, a well-respected and widely used data analysis tool for research in public and private organizations. This research analyses the survey data using the CALIS (Covariance Analysis of Linear Structural Equations) procedure in Release 9.2 Version TS2M3 (SAS, 2008). This routine provides exploratory and confirmatory factor analysis of any order, linear measurement-error models or regression with errors in variables, multiple and multivariate linear regression, multiple-group structural equation modeling with mean and covariance structures, path analysis and causal modeling, simultaneous equation models with reciprocal causation, and structured covariance and mean matrices in various forms.

CHAPTER VII

RESULTS

VII.1 Measurement Instrument

VII.1.1 Data Collection

The cover letter and its survey instrument (Appendices 1 and 2 respectively) were electronically mailed to the list of participants in the sample set in early 2013. Throughout a six month data collection period, emails were resent to those participants who had not yet responded to the survey. An additional 25 paper-based survey instruments were given out to those who were qualified and agreed to participate. The online survey instrument was closed after seven months.

Table XIV provides the data collection statistics. Although we attempted to deliver 3,419 surveys, only 3,066 (89.7%) were actually delivered due to being given invalid email addresses or the respondent had configured their system to reject such electronic surveys. The 6.7% response rate provided a sufficient number of surveys for this analysis, however the distribution between targeted respondents was significantly different. The purchased email list (Hoovers) generated only a 1.3% response rate, while the professional organizations (IIBA and PMI) demonstrated a 21.5% response rate.

These professional organizations have a clear interest in the results of the survey and often did more than just provide the survey to their members but promoted the value of the survey to their members. We presume that the general business community (those that were identified by the Hoovers list) are frequently asked to participate in business, vendor and research surveys and their desire to participate is low. Baruch & Holtom (2008) find that the response rate to business surveys has been declining for years. However, the participation rate for members of professional organizations can be expected to be much higher because they are motivated to advance their profession.

Table XIV: Data Collection Summary

Source	**Original Quantity**	**Invalid email address**	**Delivery Denied**	**Available**	**Responded**	**Responded %**
Professional Organizations	887	86	6	795	171	21.5%
Hoovers	2,532	222	39	2,271	34	1.3%
Totals	**3,419**	**308**	**45**	**3,066**	**205**	**6.7%**

VII.1.2 Missing Data

The 205 surveys received had only 15 surveys (7.3%) with missing data elements. The resulting 190 valid surveys is 18.8% greater than the minimum number derived from the Hatcher (1994) recommendation of 160 for the MFUS model (see Section VI.4.6).

VII.1.3 Respondent, Project and Company Information

Eleven questions in the survey were designed to capture data that characterizes and profiles the respondent, the project they described, and the company they referred to: i.e., the control and demographic data. Appendix 5.1 describes the projects referred to by the respondents. More than half of the projects (54.9%) are depicted as either complex or very complex; 52.4% of the projects are up to $500,000 in cost; and 48.5% are combination efforts of packaged software with customized enhancements or additions. Most of these projects (66.5%) are for internal customers alone. Appendix 5.2 documents the descriptive statistics of the survey respondents including their gender, age, years with the company, years of IS experience, and title. In general, there are almost exactly twice as many male respondents as female; 63.3% of the respondents are between the ages of 36 and 55; 63.5% of the respondents have 10 or more years of IS experience as business users; 42.6% of the respondents are non-management and 39.1% of respondents are middle management. Appendix 5.3 indicates that 45.6% of companies have over 2,500 employees and the two largest identified industries (manufacturing and healthcare/pharmaceutical) represent only 24.4% of all responses.

VII.1.4 Non-Response Bias

Non-response bias, if present, indicates that there is a difference between those who responded and those who did not which would indicate that the sample does not represent the population. We used the common testing method of dividing the survey into two groups (Armstrong and Overton, 1977; Lambert and Harrington, 1990). The first group was those that responded prior to 6/01/2013 and the second group was those who responded after 6/01/2013. We hypothesize that these two groups (those that responded with the initial request or the first reminder) have similar responses to those who responded only after two or more reminders. If this is true, then we should see no significant differences between the means for model variables and control variables. Table XLIV provides the results of *t*-tests on all manifest and control variables; all variables are significant at the 99% confidence level. Therefore, this data shows no bias between respondents and non-respondents.

VII.1.5 Common Method Bias

We performed the Harman Single Factor test on our data and find that the newly introduced single factor accounts for 44.27% of the variance which is below the threshold for exhibiting common method bias (.50). We then analyzed our data using the Common Latent Factor (CLF) technique. This analysis found that the common latent variable indicates a variance of .2702 which is also below the threshold of .50. Finally, we performed the Common Marker Variable technique using the three control variables with the lowest correlations (Project Budget, Package versus Custom Development, and Years at Company) to identify a marker variable (Lindell and Whitney, 2001). The linear coefficient of .3285 indicates a variance of .1079 that is well below the threshold of .50. Therefore, all three tests suggest that there is no common method bias present in the data.

VII.1.6 Estimation Method

SAS' PROC CALIS offers two methods for estimating the initial parameters that begin the SEM optimization process. The Maximum Likelihood (ML) method provides estimates based on the mean and variance of the independent variables in the model. The Full Information Maximum Likelihood (FIML) method is computationally more intense but can generate better estimates when there are substantial amounts of missing data in the data set. These two methods are considered equivalent when the amount of missing data is insignificant or non-existent. We expect little if any significant difference between methods since our sample data has relatively little missing data. Both estimation methods were used for the full covariance model to determine which method may provide better results, but no significant differences were detected with either the initial estimates or the final results as expected, so PROC CALIS's default method of ML was used on all subsequent analyses.

VII.2 Full Covariance Model

Hatcher (1994) recommends the use of a two-step process for testing causal models with latent variables as originally recommended by Anderson and Gerbing (1988). The first step uses the *a priori* model without the hypothesized causal relationships allowing each latent variable to freely correlate with every other latent variable to assess their reliability, validity and what, if any, modifications are needed to improve the model before continuing. This creates an acceptable measurement model using confirmatory factor analysis and is the subject of this section (Section VII.3 details the second step).

VII.2.1 Unidimensionality

A full covariance model was analyzed using the hypothesized Multiple Factor User Satisfaction model to determine the unidimensionality of this model – a critical step prior to continuing structured equation modeling (Ravichandran and Rai, 2000). Kline (2005) suggests that multiple goodness-of-fit indices are reported since no one index captures the overall concept of how good data fits a model. Table XV provides the measures from our research suggesting that the MFUS model portrays good fit. These seven statistics are included throughout this research. Hatcher (1994, pp. 187-189) recommends that an analysis of the residuals is performed to test the variability of the residuals. The author recommends that the range of residuals should be between -2.0 and +2.0 (our data has a range of -0.230 to +0.306) and the residuals should be approximately symmetrically distributed around zero (see Table XVI).

Table XV: Full Covariance Model Goodness of Fit

Statistic	**Target Value ***	**Observed Value**
Ratio of Chi-Square statistic to degrees for freedom	< 2.0	1.802
Standardized Root Mean Square Residual (SRMSR)	< 0.08	0.067
Parsimonious Goodness of Fit Index (GFI)	> 0.60	0.699
CFI (Bentler comparative fit index)	> 0.90	0.923
NNFI (Bentler and Bonnet non-normed fit index)	> 0.90	0.914
|Residuals| < 2.0	Yes	Yes
Symmetrical	Yes	Yes

* Hatcher, 1994

Table XVI: Residual Distribution

Range		Frequency	Percent	
-0.23005	-0.15337	2	0.34	
-0.15337	-0.07668	25	4.20	**
-0.07668	0	257	43.19	***********************
0	0.07668	230	38.66	********************
0.07668	0.15337	53	8.91	****
0.15337	0.23005	21	3.53	*
0.23005	0.30673	7	1.18	

VII.2.2 Normality

The normality of the manifest variables is tested using the PROC MEANS function in SAS. All independent variables are found to have a kurtosis value between -1.757 and 1.917, well within an acceptable range of ±3.0. However, as shown in Table XVII, nine of the 34 variables show skewness below the lower limit of -1.0 with four of the nine only marginally below -1.0. In all nine cases, this shows that a large majority of business users self-evaluated themselves as “Strongly Agreeing” with a statement about their involvement on the indicated measure. This skewing is a reasonable finding given that the sample set of survey respondents were people who identified themselves as being involved on IS projects. The first three instances are related to the Project Management activity. One of these three measures is only marginally beyond the threshold. Five of the remaining six instances are associated with the Business Functionality of the system with the last instance in the table related to the Technical Functionality of the system. The measures of system usage, timely delivery and accurate data have 58.16%, 47.69% and 51.53% of business users reporting "Strongly Agree" which cause the high values for skewing. This can be considered reasonable since the sample set consists of users who are involved with their IS projects and would be motivated for its success (Leonard, 2004; Barki, Titah and Boffo, 2007; Chen et al, 2011; Kelly, 2011; Huang and Kappelman, 1996). The Reliability measure within Technical Functionality has 64.29% of business users reporting "Agree" or "Strongly Agree". Wagner and Piccoli (2007) list technical functionality as one reason for project failure. They argue that when users become more involved with an IS project, failure rates decrease. Since this empirical study's sample set specifically includes involved business users, high technical functionality is a reasonable expectation.

Table XVII: Skewness

Latent Variable	Manifest Variable	Skewness
Project Management	NF27 Problem Solving	-1.239
Project Management	NF28 Risk and Conflict Management	-1.005
Project Management	NF29 Non-IS Communication	-1.146
Business Functionality	NF34 System Usage	-1.601
Business Functionality	NF35 Timely Delivery	-1.623
Business Functionality	NF36 Accurate Data	-1.663
Business Functionality	NF37 Quality	-1.098
Business Functionality	NF39 Operational Efficiencies	-1.035
Technical Functionality	NF41 Reliability	-1.286

VII.2.3 Reliability

The Cronbach alpha is calculated for each latent construct using SAS' PROC CORR as discussed in Section VI.3.4; the values are shown in parentheses in Table

XVIII. We note that all of the user activities and user satisfaction constructs (F2 through F8) have values well in excess of the standard 0.70 (the smallest being 0.816) which suggest their reliability for this study. The two pairs of constructs with high correlations (F2-F3 and F7-F8) were tested with exploratory analyses to determine whether they each are single constructs. Each analysis identified two separate factors that, according to our sample data, are highly correlated.

Table XVIII: Summary of Standardized Coefficients of Covariances

	F1	F2	F3	F4	F5	F6	F7	F8
F1 Business User	(.345)							
F2 Functional Requirements	.777 **	(.882)						
F3 Presentation Requirements	.702 **	.911 **	(.912)					
F4 Quality Assurance	.381 *	.631 **	.644 **	(.816)				
F5 Project Management	.694 **	.745 **	.593 **	.461 **	(.914)			
F6 Project Delivery	.375 *	.457 **	.374 **	.220 *	.403 **	(.835)		
F7 Business Functionality	.637 **	.616 **	.520 **	.344 **	.575 **	.722 **	(.944)	
F8 Technical Functionality	.648 **	.585 **	.490 **	.330 **	.499 **	.711 **	.948 **	(.911)

* $p < .01$ ** $p < .001$ Cronbach alpha values are in parentheses

The Cronbach alpha for the Business User construct has a value of 0.345 which is below the typical acceptable limit of 0.70. There are two explanations for this finding. First, the Business User construct is measured by only two questions in the instrument (see Appendix 2). Hatcher (1994, p. 260) recommends the use of at least three manifest variables per latent variable. Kline (2005, p. 314) suggests that although two manifest variables might be sufficient, three or more are better for the reduction of specification errors. Latent variables with less than five manifest variables can exhibit problematic results if they occur in models with small sample sizes (Johnson and Creech, 1983). However, the authors state that the "distortions [are] not of sufficient magnitude to strongly bias the estimates of important variables" (ibid, p. 406). We also compared two variations of the full covariance model: with and without the two manifest variables in question (F10 and F11, see Table XXV)[24]. The results in Table XIX show that SRMSR and the two residual analyses have the same values, while the remaining four statistics show marginally improved results for statistical fit. We also performed a partially latent structural regression analysis (Section VI.4.4.2) that showed similar results.

Table XIX: Business User manifest variable analysis

Fit Statistics	With F10 and F11	Without F10 and F11
n =	190	190
X^2 / df < 2.0	1.802	1.840
SRMSR	0.067	0.067
Parsim GFI	0.699	0.709
CFI	0.923	0.927
NNFI	0.914	0.919
|Residuals| < 2.0	Yes	Yes
Residuals symm	Yes	Yes

Second, the sample set was generated from two primary sources: a purchased multi-industry data set limited to U.S. professionals in specific job categories most likely to generate valid survey respondents and U.S. chapters of professional organizations that represent business users of IS systems (see Section VI.2.2). Given the analytical results of the full covariance models with and without the manifest variables for the Business User construct and the sample set selection process, the data indicates that the Business User construct is reliable for purposes of this study. Therefore, we use a single indicator

[24] Reference Table XXV: F10 is the manifest variable representing the degree to which a respondent was a direct user of the information system; F11 is the manifest variable representing the degree to which they represented a user of the information system.

variable (manifest variable) to represent the Business User for the remainder of this analysis.

VII.2.4 Content Validity

Establishing content validity requires an analysis of the extent to which the sample data measures the concept that it was intended to measure (Churchill, 1979). As discussed previously, the review and subsequent use of 128 studies for the foundation for this research form the basis of this content validity. It is further confirmed as part of the instrument's pre-test by 17 practitioners and one academic.

VII.2.5 Construct Validity

VII.2.5.1 Convergent Validity

Kline (2005, 60) defines a set of variables as having convergent validity when their intercorrelations are at least moderate in scale. Convergent validity is similarly described by Hatcher (1994, 332) and Anderson and Gerbing (1988) as the condition where a set of variables have paired *t*-tests values that are all significant; generally this is when $p < .05$. Table XX shows that all *t* values are significant with $p < .001$; indicating convergent validity for this sample (refer to Appendix 3.3 for the list of dependent and independent variables).

Table XX: Measurement Model properties

Dependent Variable / Independent Variable	Standardized Loading	*t*	p
F1: Business User			
F10: Customer	0.312	3.774	< .001
F11: Representative	0.620	5.654	< .001
F2: Functional Requirements			
F13: Process	0.866	40.306	< .001
F14: Calculations	0.803	27.978	< .001
F15: Data Storage	0.640	14.066	< .001

Dependent Variable / Independent Variable	Standardized Loading	*t*	p
F16: Security	0.714	18.653	< .001
F17: Task Complexity	0.835	33.228	< .001
F3: Presentation Requirements			
F18: Forms	0.865	39.679	< .001
F19: Screens	0.870	41.199	< .001
F20: Reports	0.870	41.051	< .001
F21: Queries	0.799	27.209	< .001
F4: Quality Assurance			
F22: Use of Tools	0.528	9.408	< .001
F23: Define Tests	0.911	40.363	< .001
F24: Execute Tests	0.896	38.025	< .001
F25: Use Prototypes	0.590	11.552	< .001
F5: Project Mgmt			
F26: Schedule	0.812	29.284	< .001
F27: Problem Solve	0.909	54.155	< .001
F28: Risk and Conflict Mgmt	0.868	40.548	< .001
F29: Non-IS Comm	0.835	33.103	< .001
F30: Implementation	0.743	20.971	< .001
F6: Project Delivery			
F31: Cost	0.802	22.645	< .001
F32: Schedule	0.784	21.248	< .001
F33: Scope	0.788	21.536	< .001
F7: Bus Functionality			
F34: System Usage	0.741	21.613	< .001
F35: Timely Delivery	0.877	47.552	< .001
F36: Accurate Data	0.879	48.285	< .001
F37: Quality	0.907	61.541	< .001
F38: Financial benefits	0.841	36.806	< .001
F39: Operational Efficiencies	0.879	48.335	< .001
F40: Easy to Use	0.791	27.546	< .001
F8: Tech Functionality			
F41: Reliability	0.900	53.107	< .001
F42: Easy to Maintain	0.769	24.030	< .001
F43: Easy to Test	0.837	34.331	< .001
F44: Stable	0.864	40.820	< .001

VII.2.5.2 Discriminant Validity

Hair et al (2010, p. 669) define discriminant validity as the "extent to which a construct is truly distinct from other constructs both in terms of how much it correlates with other constructs and how distinctly measured variables represent only this single construct." Hatcher (1994) states that discriminant validity is revealed when the correlation between different measures is relatively weak and suggests the use of a Chi-square difference test, a confidence interval test, or a variance extracted test. Following Hatcher, we calculate the confidence interval for each pair of covariances as two standard errors above and below the estimated covariance (see Table XXI). Discriminant validity may exist whenever the interval range includes the value of 1.0 (Hatcher, 1994, pp. 338-339; Raykov, 2011, p. 42). The only path between constructs with this characteristic is from the Business User to the Functional Requirement (H1a). Although this relationship's interval range includes 1.0, the p-value for the upper bound is only 0.0507 which is not significantly beyond the threshold. Therefore, we accept that all hypothesized paths exhibit discriminant validity.

Table XXI: Confidence Interval Test for Discriminant Validity

Path		Estimate	Standard Error	Lower Bound	Upper Bound
F1	F2	0.7768	0.1362	0.5044	1.0491
F1	F3	0.7024	0.1311	0.4402	0.9647
F1	F4	0.3809	0.1207	0.1395	0.6222
F1	F5	0.6943	0.1301	0.4342	0.9545
F1	F6	0.3755	0.1253	0.1249	0.6260
F1	F7	0.6375	0.1263	0.3850	0.8901
F1	F8	0.6482	0.1285	0.3912	0.9051
F2	F3	0.9109	0.0213	0.8683	0.9535
F2	F4	0.6306	0.0520	0.5266	0.7346
F2	F5	0.7450	0.0397	0.6657	0.8243
F2	F6	0.4569	0.0691	0.3186	0.5951
F2	F7	0.6162	0.0512	0.5138	0.7186
F2	F8	0.5855	0.0555	0.4746	0.6964
F3	F4	0.6443	0.0499	0.5445	0.7441
F3	F5	0.5925	0.0534	0.4857	0.6994
F3	F6	0.3744	0.0732	0.2281	0.5208
F3	F7	0.5200	0.0583	0.4034	0.6365

Path		Estimate	Standard Error	Lower Bound	Upper Bound
F3	F8	0.4902	0.0620	0.3662	0.6142
F4	F5	0.4614	0.0638	0.3338	0.5890
F4	F6	0.2204	0.0801	0.0601	0.3806
F4	F7	0.3441	0.0697	0.2048	0.4835
F4	F8	0.3296	0.0719	0.1858	0.4734
F5	F6	0.4033	0.0709	0.2615	0.5452
F5	F7	0.5752	0.0533	0.4686	0.6818
F5	F8	0.4993	0.0608	0.3777	0.6208
F6	F7	0.7216	0.0446	0.6325	0.8107
F6	F8	0.7111	0.0474	0.6164	0.8058
F7	F8	0.9479	0.0138	0.9204	0.9754

VII.2.6 Covariance Matrix

PROC CALIS calculates the standardized coefficients of covariance between the latent variables. Table XVIII suggests that there are three strong relationships between independent latent variables; F1-F2, F1-F3, and F2-F3 all involve the activity of providing system requirements. Since the purpose of information systems is to provide tools for business analysis and decision making, the accurate capture of the business user's requirements as communicated by the business users are critical to success (Verner et al, 2005; Chen et al, 2011; Kelly, 2011; Huang and Kappleman, 1996). The strong relationships involving the Business User and the Functional and Presentation Requirements (F1-F2 and F1-F3) support the business user's involvement in the documentation of system requirements. Significant business user involvement in both requirement activities suggests that there could be a strong correlation between the two subgroups of functional and presentation requirements (F2-F3). An Exploratory Factor Analysis was performed and it did identify that two factors are present for these measures even though the sample data indicates high correlations.

Table XVIII also suggests strong relationships between the three dependent variables: Project Delivery (F6), Business Functionality (F7) and Technical Functionality (F8). The Multiple Factor User Satisfaction model includes three dependent constructs to represent user satisfaction. The strong relationship between these dependent variables suggests that whether the user's perception of user satisfaction is positive or negative, the other user satisfaction constructs move in a corresponding direction. Again, an Exploratory Factor Analysis was performed and it did identify that two factors are present for these measures even though the sample data indicates high correlations.

VII.2.7 Manifest variable significance

The Wald Test is used to identify variables to be considered for removal from the model if their removal would improve the model's fit (Kline, 2005). This test is a stepwise process that estimates the increase in the Chi-Square fit statistic with the removal of any given independent variable. The Wald test performed by PROC CALIS specifically does not suggest the removal of any manifest variables since all manifest variables are found to be significant. Therefore, we keep all manifest variables in the measurement model.

VII.3 Full Path Model

This section documents the second step of the two-step process for testing causal models with latent variables. At this point, we modify the final measurement model previously developed to include the theorized relationships from the Multiple Factor User Satisfaction model. The result is a combined model that includes both the measurement model and this structural model with specified relationships.

VII.3.1 Unidimensionality

The first of two steps in SEM analysis suggested that all variables were reliable and valid and that none should be removed. Next, the theoretical model with paths (Figure 4) is analyzed using SAS' PROC CALIS. The initial portion of the analysis is to test this model's unidimensionality. The first column of Table XXII provides a summary of the initial path analysis ("Theoretical Model"). The goodness of fit statistics suggest that the theoretical path model does portray good fit. Table XXIII, the residual distribution, documents that all standardized residuals are within ±2.0 and that they are approximately symmetrical around zero. The results are summarized in Figure 10.

Table XXII: Path Analysis

Dependent Variable / Independent Variable	Theoretical Model	Alternative 1: No F5-F6	Alternative 2: No F5-F6 No F5-F7	Alternative 3: No F5-F6 No F5-F7 No F5-F8	Alternative 4: No F5s No F4s
n	190	190	190	190	190
Functional Reqmts‡	1.07 ***	1.03 ***	1.02 ***	1.01 ***	1.01 ***
Presentation Reqmts‡	0.91 ***	0.96 ***	0.97 ***	0.98 ***	0.99 ***
Quality Assurance‡	0.61 ***	0.65 ***	0.65 ***	0.65 ***	0.63 ***
Project Mgmt‡	0.72 ***	0.69 ***	0.68 ***	0.68 ***	0.70 ***
Project Delivery					
Func Rqmt	7.62 *	4.22 ***	4.64 ***	4.95 ***	4.77 ***
Pres Reqmts	-5.53 *	-3.55 ***	-4.01 **	-4.33 **	-4.35 **
QA	-1.09 *	-0.37 **	-0.32 *	-0.30 *	
Proj Mgmt	-1.37 †				
Bus Functionality					
Func Reqmts	9.81 *	5.86 ***	6.06 ***	6.63 ***	6.29 ***
Pres Reqmts	-7.15 *	-4.90 ***	-5.25 **	-5.83 **	-5.71 **
QA	-1.34 *	-0.43 **	-0.35 **	-0.33 **	
Proj Mgmt	-1.72 †	-0.13			
Tech Functionality					
Func Reqmts	10.33 *	6.20 ***	6.46 ***	6.50 ***	6.27 ***
Pres Reqmts	-7.52 *	-5.18 ***	-5.59 ***	-5.75 **	-5.71**
QA	-1.39 *	-0.44 **	-0.35 *	-0.31 *	

Dependent Variable / Independent Variable	Theoretical Model	Alternative 1: No F5-F6	Alternative 2: No F5-F6 No F5-F7	Alternative 3: No F5-F6 No F5-F7 No F5-F8	Alternative 4: No F5s No F4s
Proj Mgmt	-1.93 †	-0.26 †	-0.13 *		
Fit: X^2 / df < 2.0	1.900	1.923	1.921	1.927	1.923
SRMSR	0.071	0.070	0.070	0.070	0.073
Parsim GFI	0.711	0.709	0.710	0.710	0.713
CFI	0.921	0.919	0.919	0.918	0.917
NNFI	0.913	0.911	0.911	0.910	0.910
|Residuals| < 2.0	Yes	Yes	Yes	Yes	Yes
Residuals symm	Yes	Yes	Yes	Yes	Yes

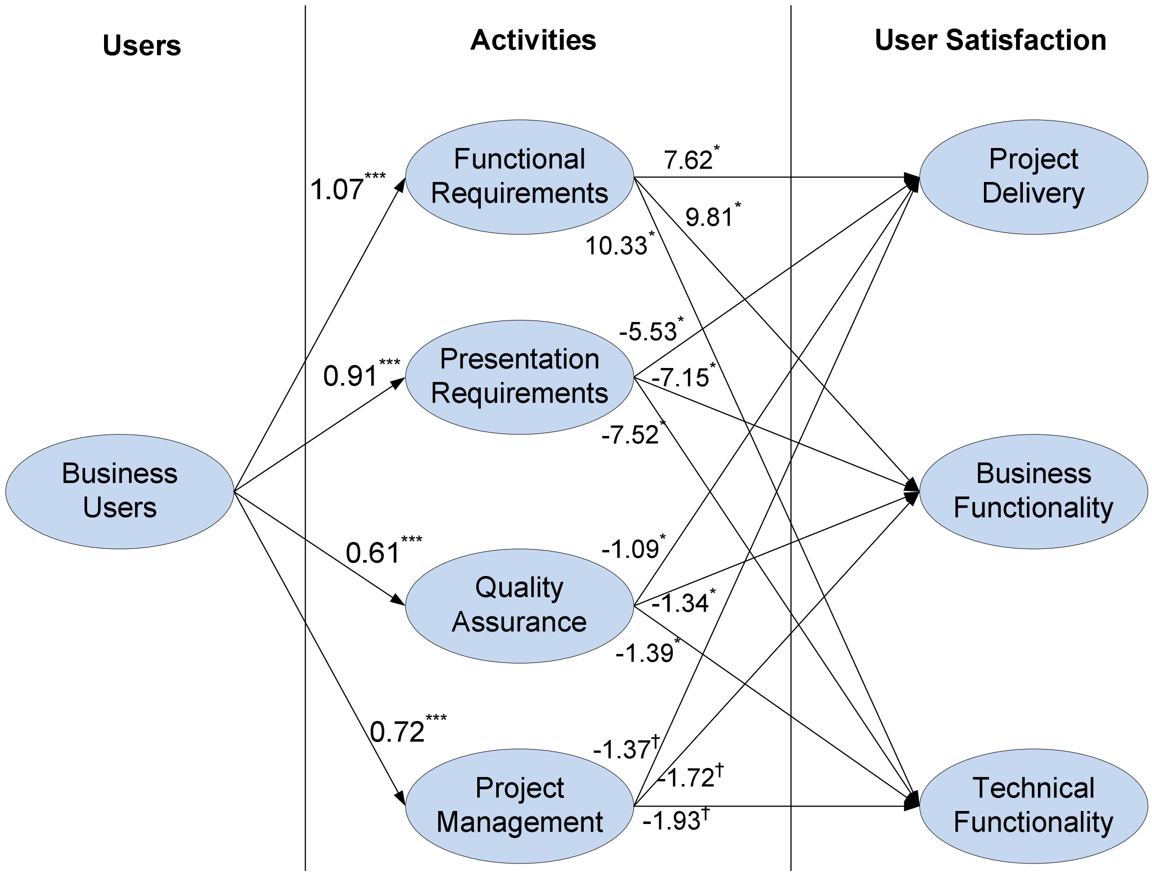
‡ Business User is the independent latent variable

† p < .10, * p < .05, ** p < .01, *** p < .001

Table XXIII: Residual Distribution

Range		Frequency	Percent	
-0.23107	-0.15405	1	0.19	
-0.15405	-0.07702	22	4.17	**
-0.07702	0	234	44.32	**********************
0	0.07702	196	37.12	******************
0.07702	0.15405	48	9.09	****
0.15405	0.23107	17	3.22	*
0.23107	0.30809	10	1.89	*

Figure 10: Path Analysis Results



† p < .10, * p < .05, ** p < .01, *** p < .001

VII.3.2 Path Analysis

The Wald test suggested analyzing the incremental removal of the paths from the Project Management activity to the three dependent variables; this analysis could indicate that a simpler model may generate a better model as measured by the goodness of fit statistics. The sequential removal of these paths from the theoretical model was analyzed; the results are shown in Table XXII next to the Theorized Model. "Alternative 1" represents the removal of the first identified single path (represented by H5a); "Alternative 2" is the removal of two paths (H5a and H5b), and "Alternative 3" is the removal of all three paths (H5a, H5b, and H5c). These three alternative models do not significantly change the model's fit across any of the goodness of fit statistics.

The Wald test further identified the removal of all three paths from the Quality Assurance activity to the three dependent variables. "Alternative 4" represents the removal of six paths: three from the Project Management activity and three from the Quality Assurance activity (represented by H4a, H4b, and H4c). Again, we see no significant change in the model's fit from the original theoretical model. Therefore, given the content validity of these business user activities and their theorized impact on the user satisfaction variables, we retain these paths. Figure 10 shows the MFUS model with the results of the completed analysis.

VII.3.3 Path discussion

This section discusses the analysis of each research hypothesis. Table XLV contains a summary of the various business user activities.

VII.3.3.1 Hypothesis 1: Business Users

Hypothesis 1 proposes that a business user's involvement positively impacts each of the four business user activities in this research: H1a (Functional Requirements), H1b (Presentation Requirements), H1c (Quality Assurance) and H1d (Project Management). This analysis finds support for all four parts of this hypothesis (see Table XXII, "Theoretical Model"). The impact of business users on Functional and Presentation Requirements are greater than the impact on Quality Assurance and Project Management, but all are supported. All four parts of this hypothesis are also supported in each of the alternative models analyzed (Section VII.3.2 discusses the alternative models that were all discarded since they did not significantly change the model's fit).

VII.3.3.2 Hypothesis 2: Functional Requirements

Hypothesis 2 proposes that Functional Requirement activities positively impact all three User Satisfaction measures: H2a (Project Delivery), H2b (Business Functionality), and H2c (Technical Functionality). This study finds support for all three parts of this hypothesis (see Table XXII, "Theoretical Model"). These impacts have the greatest magnitude of any impact on the three user satisfaction measures. All three parts of this hypothesis are also supported in all of the alternative models analyzed in Section VII.3.2. The MFUS model explicitly measures user satisfaction as three separate latent variables to capture the multidimensionality of user satisfaction (Pinto and Slevin, 1988) and indicates that functional requirements activity positively influences Project Delivery, Business Functionality and Technical Functionality. We performed an analysis of business users who described themselves with high or low levels of involvement (Table XLV) and found no significant difference from the analysis without such a distinction.

VII.3.3.3 Hypothesis 3: Presentation Requirements

Hypothesis 3 proposes that Presentation Requirement activities positively impact all three User Satisfaction measures: H3a (Project Delivery), H3b (Business Functionality) and H3c (Technical Functionality). The data suggest that Presentation Requirement activities negatively impact all three user satisfaction measures (see Table XXII, "Theoretical Model"). The analysis of alternative models in Section VII.3.2 also finds support for this negative impact relationship.

This significant yet negative finding motivated additional analyses that did not provide significant additional insight for ten of the eleven variables[25]. However, there is an indication that if the business user was a middle manager, this relationship does become positive as hypothesized (see a further discussion of this analysis in Section VIII.2.2.2). If the general business user's involvement providing presentation requirements to IS projects do not increase their satisfaction with the project, this is contradictory to the literature and light weight methodologies. This would not have been detected in previous studies because the gathering of requirements was not separated into two constructs.

VII.3.3.4 Hypothesis 4: Quality Assurance

Hypothesis 4 proposes that Quality Assurance activities positively impact all three User Satisfaction measures: H4a (Project Delivery), H4b (Business) and H4c (Technical Functionality). The data suggest that Quality Assurance activities negatively impact all three User Satisfaction measures (see Table XXII, "Theoretical Model"). The magnitude of this impact is smaller than the impacts from either Functional or Presentation Requirements. The analysis of the first three alternative models (Section VII.3.2) also supports these negative relationships. An analysis of survey respondents who described their level of involvement in Quality Assurance activities as being high or low was similar to the overall model's results (Table XLV).

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[25] An additional model containing only the two requirements gathering activities was inconclusive regarding these hypothesized relationships. An analysis of respondents describing their level of involvement with presentation requirements as being high or low (Table XLV) found no difference in outcomes. The analyses of control variables also did not suggest an impact to this relationship.

Business users typically focus on performing their own work; becoming involved in testing someone else's work can be perceived as unproductive for themselves and leave them with a poor perception of the project. Additionally, their involvement in this phase will expose them to many errors ("bugs") that would normally have been addressed prior to them seeing the results of the development effort if they had not been involved, which again could leave them with low regard for the development project. This counterintuitive finding is further discussed in Section VIII.2.3.

VII.3.3.5 Hypothesis 5: Project Management

Hypothesis 5 proposes that Project Management activities positively impact all three User Satisfaction measures: H5a (Project Delivery), H5b (Business Functionality) and H5c (Technical Functionality). This study finds weak support for all three paths having a negative relationship with their corresponding user satisfaction measure (see Table XXII, "Theoretical Model"). These findings may indicate that the typical business user is unaware of the myriad of details involved with managing an IS development project. Their involvement exposes them to the number of risks and issues addressed in the day-to-day management of IS projects that normally they would not have a need to know since most are resolved within the development team. Although their involvement may be potentially beneficial to the project manager when they can inject the business perspective or address business constraints, the overall affect may be damaging to their own perception of the benefits of project management in general.

These weak relationships were identified to be removed in the full path analyses in an attempt to simplify the model (see Section VII.3.2); however, the model's fit and relationships did not significantly change with these relationships being removed.

Similar to the discussion concerning user involvement with quality assurance activities, their involvement with selected project management activities may be perceived as helping other people to their work, even if the specifics of their involvement contribute to the project (such as communicating to the business staff, resolving business risks, and coordinating schedules across multiple teams). Table XLV shows the results of an analysis comparing respondents with high and low levels of involvement on Project Management; the results generally followed those of all respondents combined.

VII.4 Control Variable Analyses

This section provides a thorough analysis of all 11 control variables to identify any influence on the model that may exist; these variables are divided into three groups (Project Information, Respondent, and Company Information) discussed below.

VII.4.1 Project Information

Four control variables measure project characteristics that the business user provided as part of this survey. The literature suggests that selected characteristics of a project may have some impact on the business user's perception of user satisfaction. Questions 10 through 13 on the survey (Appendix 1) show the specific questions; the following sections address each variable individually. Appendix 5.1 (Table XXXIII, Table XXXIV, Table XXXV, and Table XXXVI) provides descriptive statistics and Appendix 8 (Table XLVI) summarizes the analyses of these variables.

VII.4.1.1 Project Complexity

We define low project complexity as those surveys that identify themselves as being "very simple", "simple", or "average", and high project complexity as all surveys that identify themselves as being "very complex" or "complex". Although these definitions generate a sufficient number of observations for the analysis to be performed, the goodness of fit statistics are poor and the results are either statistically weak or insignificant (Table XLVI).

VII.4.1.2 Project Budget

We define a low Project Budget as being any project with a budget of less than $1,000,000, and a large Project Budget as any project with a budget greater than $1,000,000. These definitions generate sufficient observations for the analysis to be performed (Table XLVI). For those projects with budgets under $1,000,000, Hypotheses 1 and 2 are found to be statistically significant and similar to the full model's results. Hypotheses 3 and 4 are not supported; they do have statistical significance for negative relationships and similar to the full model's results. Hypothesis 5 is not supported since all three relationships either support a weak negative relationship or are inconclusive. The analysis of large projects shows poor goodness of fit statistics. When the project budget is controlled, we find that project budget does not significantly alter the findings of the full model.

VII.4.1.3 Package versus Custom Development

The questionnaire asked respondents to characterize their project as being primarily the installation of a package, fully custom developed, or a combination of the two. Table XLVI provides the results of this analysis. Although only two of the three characterizations could be analyzed and the results did not show good fit statistics, the results that were obtained generally agree with the full model's results.

VII.4.1.4 System User

The questionnaire asked respondents to characterize their project as being primarily intended for use by internal users, customers (external users), or a combination of both groups. Those projects that were intended for use by internal users have a sufficient number of observations to generate results but only a selected number of fit statistics suggest an acceptable model (Table XLVI). Hypothesis 1 was fully supported statistically with all four parts having similar results to the full model. The analysis of the remaining hypotheses indicates either weak support or inconclusive results; their magnitude and direction of the standardized coefficients match those of the full model's relationships. Those projects whose users are both internal and external to the firm also have a sufficient number of observations to generate results but exhibit poor goodness of fit. Hypothesis 1 is fully supported statistically with all four parts having similar results to the full model. The analysis of the remaining hypotheses generate inconclusive results, however their magnitude and direction of the standardized coefficients match those of the full model's relationships. Those projects whose users are primarily external do not have a sufficient number of observations to generate results. Therefore there are no significant findings from this data.

VII.4.2 Respondent

Five control variables measure characteristics about the business user themselves. The literature suggests that various characteristics of the respondents, although not the primary focus of this research, may have some impact on the business user's perception of user satisfaction. Questions 14 through 18 on the survey show the actual questions; the following sections address each variable individually. Appendix 5.2 (Table XXXVII,

Table XXXVIII, Table XXXIX, Table XL and Table XLI) provides descriptive statistics for these variables and Appendix 8 summarizes the analyses of these variables across two tables (Table XLVII and Table XLVIII).

VII.4.2.1 Gender

The respondents were asked to identify themselves as male or female. Although the number of males was approximately double the number of females, both analyses had sufficient observations to generate results (Table XLVII). Hypothesis 1 for males is supported with similar findings as those from the full model. However, Hypotheses 2, 3, 4 and 5 for males indicate either weak support or inconclusive results. The analysis for females indicated many poor fit statistics. Hypotheses 1 and 2 for females are supported. Hypothesis 3 is not supported; instead it finds a statistically significant negative relationship between Presentation Requirements and each of the three user satisfaction constructs. The magnitudes of these standardized coefficients are similar to those from the full model's results. Hypotheses 4 and 5 are inconclusive for female respondents. Therefore, we find that gender has no significant impact on the findings.

VII.4.2.2 Age

All respondents were asked to identify themselves into one of six age ranges. We define "Younger" respondents as those with ages up to 45 years, and "Older" respondents as those with ages above 45. The analysis of respondents by age has only two of five fit statistics suggesting that the data does not have a good fit to the model (Table XLVII). Hypotheses 1 and 2 suggest that both may be supported by data from younger respondents. Hypotheses 3and 4 are not supported but are statistically significant for a negative relationship. Hypothesis 5 showed inconclusive results. Hypothesis 1 is fully supported by surveys from older respondents. However, the data from older respondents does not generate results for the remaining hypotheses due to high standard errors, therefore no findings are reported. Since this data does not have a good fit and one set of hypotheses could not be analyzed, we cannot form any conclusions based on the respondent's age.

VII.4.2.3 Years at Company

All respondents were asked to identify the number of years they have worked at the company as of their survey date in one of six categories. We define a respondent as having a low number of years if they have worked at that company for less than 10 years, and a high number of years if they have worked at that company for 10 or more years. The sample size for those with 10 or more years at the company is too small to generate results; there is sufficient data to generate results for those with less than 10 years at their company but only two of five goodness of fit statistics indicate a good fit (Table XLVII). Hypotheses 1 and 2 are fully supported for those with a low number of years. Hypotheses 3 and 4 are not supported, but they each show statistically significant negative relationships. Hypothesis 5a is supported, but Hypotheses 5b and 5c are not supported. The data shows statistically significant negative relationships for both Hypotheses 5b and 5c that has only weak support in the analysis of the full theoretical model. Therefore we find that years of employment at a company has no significant impact on the research findings.

VII.4.2.4 Years with Information Systems experience

All respondents were asked to identify the number of years' experience in working with information systems in one of six ranges of years. We define a low number of years' experience as less than 10 years, and a high number of years' experience as 10 or more years. For those respondents with a low number of years with IS experience, the data exhibits poor statistical fit and has high standard errors (Table XLVIII). For those survey respondents with a high number of years' experience, Hypotheses 1 and 2 are fully supported. Hypothesis 3 is not supported but does have support for negative relationships between Presentation Requirements and all three user satisfaction measures. Hypotheses 4 and 5 are not supported but indicate negative relationships. Generally, we find that a person's years of experience with information systems does not significantly impact the research findings.

VII.4.2.5 Title

All respondents were asked to select a generic title from a list of four that they have at their company. There are enough responses for the titles of "Non-management" and "Middle-management" that those values can be analyzed; however the sample sizes for both "Executive" and "Supportive" titles do not have enough data to perform the analyses and therefore are not reported here (see Table XLVIII and Table L). Only three goodness of fit statistics suggest that the data fits the model. Hypothesis 1 is supported for both Non-management and Middle-management titles. Non-management respondents indicate support for Hypothesis 2. The findings for Hypothesis 3 are not supported; however there is a suggestion of a negative relationship between Presentation Requirements and the Business Functionality and Technical Functionality constructs. Neither Hypotheses 4 nor 5 are supported for Non-management.

The Middle management respondents do not show support for Hypotheses 2, 3, 4 or 5. Although this analysis of middle management is inconclusive and poorly fitted, we note some potentially interesting results. In all analyses of Hypothesis 2 without controlling for title, the impacts were large and positive. However, when controlled for the user's title, non-management users have among the smallest positive impact on the relationship between Functional Requirements and Project Delivery. More interesting is that middle-management users seem to suggest a relatively high negative impact on this relationship. We see that non-management users maintain a generally negative relationship between Presentation Requirements and Project Delivery, but middle-management users have a relatively high positive impact on this relationship. The analysis by user title continues with non-management users having similar standardized coefficients for Hypotheses 4 and 5, but middle-management users have positive impact on the user satisfaction measures.

The MFUS model was reduced in complexity to analyze what effect controlling for the respondent's title has on a simpler model (see Table LI). The data shows that Hypothesis 1 is fully supported in all cases. The data from all respondents as well as when controlled for only non-management respondents support Hypothesis 2 and do not support Hypothesis 3. The data from middle-management respondents are inconclusive for all remaining hypotheses. Therefore, although we do not find a significant impact based on a business user's title, the data suggests that a business user's title may moderate relationships between the constructs.

VII.4.3 Company Information

Two control variables measure characteristics about the company that the survey respondent worked at when completing the questionnaire. The literature suggests that certain characteristics of the company, although not the primary focus of this research, may have some impact on the business user's perception of user satisfaction. Questions 19 and 20 on the survey show the actual questions; the following sections address each variable individually. Appendix 5.3 (Table XLII and Table XLIII) provides descriptive statistics for these variables and Appendix 8 (Table XLIX) summarizes the analysis of the company size.

VII.4.3.1 Company Size

All respondents were asked to categorize the size of the company based on the number of employees into one of six ranges. We define a small company as having fewer than 1,000 employees and a large company as having over 1,000 employees. These definitions generate sufficient observations for the analysis to be performed however the goodness of fit statistics are poor and the results have no statistical significance (Table XLIX).

VII.4.3.2 Industry

Table XLIII tabulates the diversity of completed surveys by industry. Manufacturing is the largest industry segment (26 respondents) but that represents only 12.7% of the sample. Seventy two of the respondents (35.1%) either didn't specify an industry or had unique industries that did not combine well with others. There is no industry that has a sufficient number of observations to generate an analysis by industry. This suggests that the survey has broad industry representation and that the findings may be generalized across industries.

CHAPTER VII

DISCUSSION AND MANAGERIAL IMPLICATIONS

This chapter presents a detailed discussion of the various constructs and their inter-relationships. The first section discusses the overall results of this empirical research, the second section presents a detailed discussion of each of the constructs, and the third section details the analyses by control variable.

VIII.1 General Discussion

The data from this empirical study exhibits excellent measurement characteristics evidenced by consistently acceptable levels of reliability, validity, and unidimensionality[26]. This indicates that the respondents believe the model's factors to be important and relevant to the process of creating information systems for their use. The results showed that the respondents represented a wide range of industries which speaks to the generalizability of the findings across industries. The large sample size also contributes to the statistical significance of the findings. An analysis of each control

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[26] The low Cronbach's alpha and two instances of high correlations were discussed in Section VII.2.3.

variable found no significant change in the findings with one exception. The respondent's title may positively impact the relationships originating with the Presentation Requirements' construct. Table XXIV summarizes the MFUS model's paths.

Table XXIV: Structural Model Results

Hypothesized Relationship	Standardized Estimate	P-value	Supported
H1a: BU to FR	1.07	< .001	Yes
H1b: BU to PR	0.91	< .001	Yes
H1c: BU to QA	0.61	< .001	Yes
H1d: BU to PM	0.72	< .001	Yes
H2a: FR to PD	7.62	< .050	Yes
H2b: FR to BF	9.81	< .050	Yes
H2c: FR to TF	10.33	< .050	Yes
H3a: PR to PD	-5.53	< .050	No
H3b: PR to BF	-7.15	< .050	No
H3c: PR to TF	-7.52	< .050	No
H4a: QA to PD	-1.09	< .050	No
H4b: QA to BF	-1.34	< .050	No
H4c: QA to TF	-1.39	< .050	No
H5a: PM to PD	-1.37	< .100	Inconclusive
H5b: PM to BF	-1.72	< .100	Inconclusive
H5c: PM to TF	-1.93	< .100	Inconclusive

VIII.2 Theoretical Constructs

VIII.2.1 Business User

This research focused exclusively on the business user to advance our understanding of their satisfaction with the IS projects they have participated on. The survey respondents represent a large number of business users from a highly diverse set of industries. An analysis of the data additionally suggests that the survey responses have acceptable levels of reliability and validity. We identified four user activities on IS projects based on the literature and hypothesized positive impacts on all four activities given the business user's involvement. Our analyses of the business user's involvement on all four measured project activities confirmed their positive impact on those activities; this confirms previous research regarding functional and presentation requirements gathering, quality assurance, and project management.

VIII.2.2 Requirements

User participation in the discovery, documentation, and verification of business requirements has been documented in a number of studies and has been found to be a significant contributor to IS solutions. There are unique challenges to the creation of quality requirements including limited face-to-face opportunities for communication and users with limited technical knowledge which constrains their ability to foresee or articulate their requirements. The literature suggested that the MFUS model separate the process of gathering business requirements into two constructs. The analysis of these two constructs suggested that they may not be two distinct constructs (indicated by a correlation of 0.911). However, we performed an exploratory factor analysis which identified that two factors should be kept; it happens that these two constructs are highly correlated for this sample data. This section discusses our findings of these two constructs.

VIII.2.2.1 Functional Requirements

Functional Requirements (process, calculations, data storage, security, and task complexity) have been the core of requirements research. Previous research finds that user involvement on such requirements activities has a positive relationship on user satisfaction. This research confirms the previous research and enhances the literature since our sample size, industry diversity, and comprehensive model is a more robust research environment that can generate significant and broadly applicable findings. The findings also remained significant across all control variables. Therefore, we find that IS project functional requirements benefit from involved business users of all types.

VIII.2.2.2 Presentation Requirements

This research is the first empirical study of Presentation Requirements as a separate construct (forms, screens, reports, and queries). We hypothesized that these characteristics of information system requirements would follow the positive relationship characteristics of user involvement in gathering the Functional Requirements. However, we find that a business user's involvement in gathering presentation requirements negatively impacts the user's satisfaction with the information system.

All analyses of this construct by the control variables also suggested this negative relationship with one exception: An analysis of respondents identifying themselves as "middle management" did show (although without statistical significance) a positive relationship as hypothesized (Table L). The business user assigned to actually using the information system as a part of their daily responsibilities is closest to the functional requirements of the system. Middle managers are responsible to take the standard outputs and results from ad-hoc queries to make business decisions. Therefore, they frequently alter their information requirements and report options (such as data sequence, filters, logic, and graphics). In our sample data, middle managers had a slightly higher average level of agreement over non-management users regarding their involvement on Presentation Requirement activities compared to Functional Requirement activities (4.55 vs. 4.36 on a 7-point Likert scale).

This finding is very interesting since it suggests that there are additional constructs or mediating factors (possibly including the business user's title or role) beyond this comprehensive research model affecting a user's involvement with documenting system requirements. Although our data was statistically inconclusive for this particular analysis, it may be a key for further research opportunities. Additional research is important because the literature and practitioner domain popularly supports the idea that user involvement can only positively impact user satisfaction with the completed information system.

VIII.2.3 Quality Assurance

Light weight methodologies recommend that users be involved with quality assurance activities on information system projects so that their expected functionality is adequately tested (as opposed to the information system professional's perception of system functionality). The literature also supports this hypothesis. Our data found a weak negative relationship between a user's involvement on quality assurance activities (the use of quality assurance tools, definition of test cases, the execution of tests, and the use of prototypes) and all three user satisfaction constructs. We suspect that involving business users in the various quality assurance activities benefits the project because they are uniquely qualified to design system tests and interpret the results. However, this greater level of involvement may be exposing them to the intricacies of testing information systems – a highly detailed and intensive activity. Additionally, software testing often uncovers numerous defects that are fixed prior to implementation. User involvement makes the identification and remediation of defects more visible to them and may decrease the user's satisfaction with the final result even if the final product meets their requirements. As a result, they are left with a general impression of how much can go wrong which in turns lowers their general satisfaction with the system. Analyses by the control variables did not suggest what additional factors may be involved with these results. We note that this study did not measure the quality of the IS project's deliverable, and therefore the product itself may be of good quality as a result of their involvement, but their satisfaction is decreased because of their involvement. Therefore, when this construct is studied within a comprehensive model with a large sample size and industry diversification, we find that user involvement may negatively impact all three user satisfaction measures.

VIII.2.4 Project Management

Project Management on information system projects requires that the project manager have some domain knowledge in the technologies being employed. Large business systems often involve business change, coordination and communication activities that an IS project manager may not be able to adequately perform. Light weight methodologies recommend that users assist with selected project management activities. The literature suggested that scheduling, problem solving, risk and conflict management, non-IS team communication, and implementation are appropriate tasks that can benefit from the business user's involvement. Our data finds a weak negative relationship between user involvement on project management activities and the three user satisfaction measures. We speculate that as business users experience the many details and risk management activities performed by an IS project manager, their perception of the overall project is degraded which in turn lowers their overall satisfaction. For example, if they were limited or even excluded from many of the project management activities, the project manager would have an opportunity to address the risks within the development team and report progress shielding them from the technical and functional issues that were identified and resolved.

VIII.2.5 User Satisfaction

The requests from the literature for a more comprehensive model motivated us to identify three constructs for User Satisfaction. Project Delivery is defined in this research as the traditional "triple constraint" measures of time, cost and scope. Business Functionality is the combination of multiple measures related to the business user's perception of the system's performance in a production environment and its impact on the applicable business processes. Finally, Technical Functionality represents the business user's observations of how the technical environment and components affect the performance of the information system.

All three constructs were impacted by user involvement on the four activities in the MFUS model at $p < .05$, with the Project Management activities impacting these constructs at $p < .10$. The impacts from Functional Requirements were positive as hypothesized, but all three of the remaining sets of relationships were negative which contradicts the hypothesized relationships. We find that these dependent constructs were highly correlated which indicates the strength of the research results; regardless of whether the impact from user activities was found to be positive or negative, these three constructs had similar relationships[27]. Therefore the multiple user satisfaction constructs indicate consistent findings.

VIII.3 Control Variables

Four variables describing a project's characteristics were captured and analyzed (project complexity, project budget, software package type, and system user). Our data shows that User Satisfaction is not significantly affected by any of these factors (Table XLVI).

Five variables characterizing the survey respondent were analyzed (Table XLVII and Table XLVIII). Four of these variables had no significant impact to the findings (gender, age, years at the company, and years with IS experience). However, the respondent's title showed the possibility of impacting the relationship between the Presentation Requirements and all three of the dependent user satisfaction variables[28]. We reduced the complexity of the MFUS model to that shown in Figure 11 by eliminating the Quality Assurance and Project Management constructs and their relationships to examine the simplified model. We observe that this reduced model also demonstrates the impact to be negatively related for all respondents while demonstrating

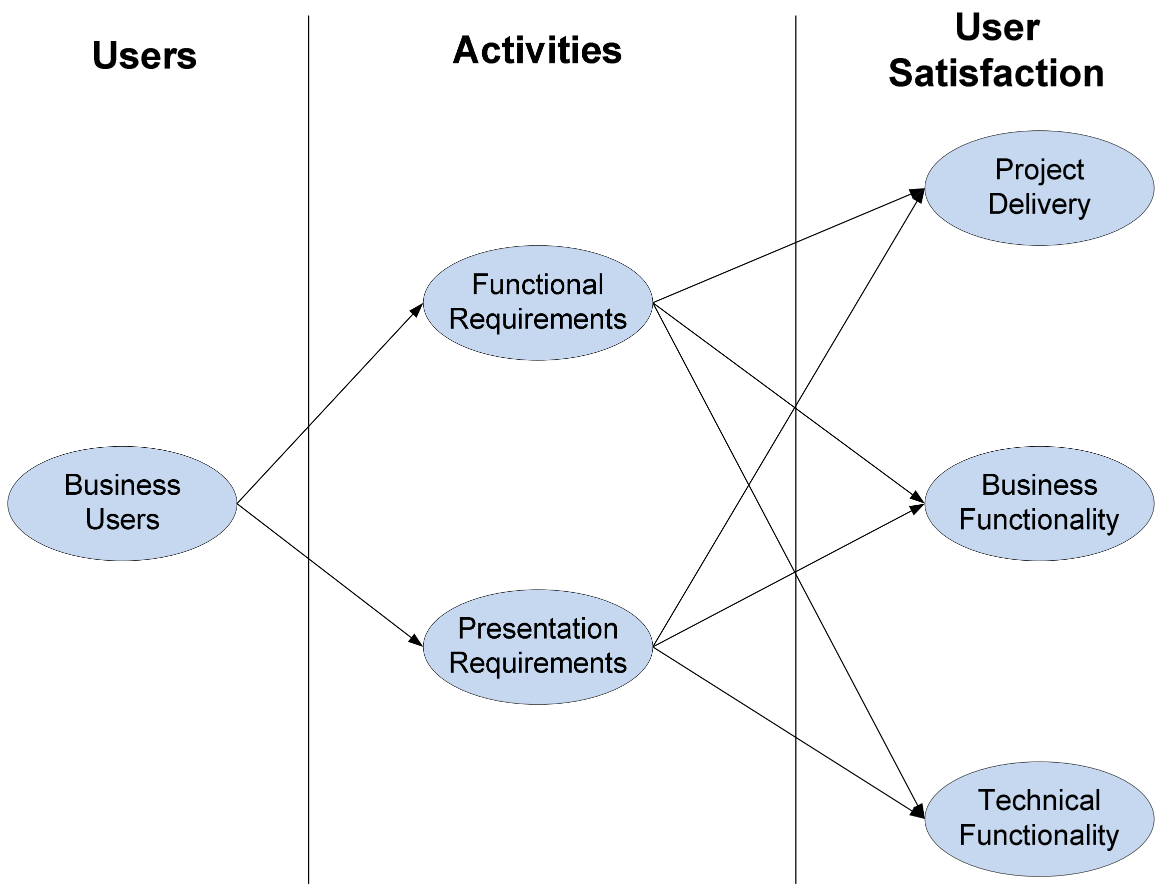
[27] An exploratory factor analysis between the highly correlated Business Functionality and Technical Functionality constructs finds that they are separate constructs that happen to be highly correlated (see Section VII.2.3).

[28] This finding is statistically inconclusive, but an examination shows that all other changes in control variables maintained the general direction of impact whereas for the middle manager, the direction of impact was reversed.

inconclusive results when controlled for middle managers (Table LI). Therefore, the data suggests that the user's title may have a moderating effect on user satisfaction.

The third set of control variables address the respondent's company by measuring their size (number of employees) and their industry. The data suggests that the findings are not affected by the number of employees (Table XLII). An analysis by industry was not possible because of the large number of industries represented. Although this makes our findings able to be generalized by industry, the sample size was not large enough to conduct analyses by specific industry.

Figure 11: Reduced MFUS Model



CHAPTER IX

SUMMARY AND CONCLUSIONS

IX.1 Summary of Results

We created and tested the Multiple Factor User Satisfaction (MFUS) model to address recommendations in literature for a more comprehensive model with multiple user satisfaction measures using a large sample set consisting exclusively of business users. We believe that the MFUS model is the first empirical study where business requirements are split into separate functional and presentation constructs based on the literature. The sample size was greater than the minimum required for statistical significance; it was also diversified by industry thereby supporting the generalizability of the findings. The three user satisfaction constructs indicated consistency across all activities.

There is a large body of theory and empirical support for the benefits of UI and UP in IS projects despite a smaller body of non-supportive or contradictory findings. Research in corollary domains such as psychology, marketing, and organizational behavior also support UI and UP in various forms. Newer "light weight" methodologies are specifically designed for enhanced UI to enable responsive, flexible, and consistent IS project delivery. Each situation is unique due to its organizational, industrial, cultural, technical, and regulatory environments, so care should be taken to identify and address the particular strengths, weaknesses, opportunities, and risks in their environment. However, our research is the most comprehensive and generalizable study of UI on IS projects currently available.

Business user involvement on requirements gathering activities showed mixed results. Their involvement on gathering functional requirements was supported which confirms the literature. However, their involvement with gathering presentation requirements suggested that it negatively impacted their satisfaction with the project. An analysis of middle managers suggested that they had the opposite experience since for that user community; they experienced a positive impact on satisfaction. Business user involvement on quality assurance and project management activities suggest that the business users do not perceive benefits from their involvement. This contradicts the assumptions of newer light weight methodologies.

IX.2 Research Contributions

IX.2.1 Researchers

The study first confirms previous research findings that show user involvement on IS projects positively impacts user activities. The data indicates that user involvement on functional requirements positively impact project delivery, business functionality, and technical functionality which supports prior research. However, by separating functional and presentation requirements, we sharpen our understanding of the collection of business requirements. Although the literature suggested that user involvement in the gathering of presentation requirements would positively impact the user satisfaction measures, we find that these relationships almost always have a negative relationship.

The sole exception to this finding is when the data is controlled by the user's title; then we find that middle managers positively impact the dependent variables as hypothesized. These findings significantly contribute to this research domain since they are based on a large sample size of business users that can be generalized across industries; they also demonstrate a need for additional research to increase our understanding of these relationships.

Further analyses by the eleven control variables found generally consistent results with one exception. We find the possibility that the user's job title may influence the impact of presentation requirements on user satisfaction. Our findings that reverse the direction of impact based on the user's title demonstrate a need for further research into the importance, mechanics and influences involved with the discovery and documentation of information system functional and presentation requirements.

IX.2.2 Practitioners

We anticipate practitioners benefitting from this study by involving appropriate users on specific activities that are shown to be effective. For example, our findings indicate that user involvement gathering functional requirements positively impact user satisfaction. This confirms the generally accepted recommendation from prevalent light weight methodologies. Information system periodicals provide anecdotal reports and case studies that suggest that user involvement on presentation requirements, quality assurance, and project management activities would also benefit a project; this is supported by a few research studies. However, our research finds the opposite effects being demonstrated. We document that most of the control variables have little, if any, impact on the relationships studied. The only exceptions were with regard to users with the title of “middle manager” having a positive impact on user satisfaction whereas all other user titles demonstrate a negative impact. This leads us to caution practitioners with regards to the generally accepted heuristic of always involving business users whenever possible. Organizations may be able to address these issues by appropriate training of users regarding the complexities of IS projects or controlling the amount of their involvement on selected activities.

IX.3 Limitations of this Research

Empirical research is beneficial because of its use of data obtained from observations of the business environment. However, that same characteristic poses a limitation because the researcher is constrained by the quantity of data received and how well (or poorly) it represents the research population. This study was limited to business users in the United States of America and therefore cannot be generalized to other countries or cultures. Although this data is well represented across multiple industries, it does not capture enough data to analyze the results by any specific industry. Generally there are differences between industries with regards to information systems so although this study’s results are generalizable, it masks potential differences between industries. This study assumed that business users were involved throughout the entire project life cycle and specifically did not study user involvement by project phase (i.e., a longitudinal study); therefore the findings do not represent any differences by project phase.

The two requirement constructs were highly correlated yet generated new insight into the capturing of business requirements. We recommend that the measures be researched and improved to better support these constructs to reduce their correlation. A more focused literature review or case study could uncover additional significant variables for such a study. The two user satisfaction constructs that were highly correlated may benefit from a number of different approaches. For example, user satisfaction could be modeled by a multi-dimensional second order construct. The measures for these constructs may be able to be improved to increase discrimination.

IX.4 Future Research Directions

This study has demonstrated the value of separating the gathering of system requirements (traditionally considered to be a single construct) into the two distinct constructs of functional and presentation requirements. We find that they have different characteristics as determined by the business users themselves. Most notably, we find the possibility that the user's title may impact how their involvement with presentation requirements affects user satisfaction with the completed system. Therefore, we recommend that future research include a more sophisticated user profile to identify possible moderating factors based on the business user's profile.

Our sample set was limited to businesses within the United States of America. Literature documents that there are cultural and national differences that impact project performance. Therefore we propose that future research could include a larger geographic sample to be able to capture those dimensions to this research topic. Finally, future research would benefit from an analysis by industry since the literature documents differences between industries. Therefore, we recommend either a significantly larger sample size to allow for an analysis by industry or a sample set that is focused on a small number of industries.

Project management and quality assurance activities have been well studied. Practitioners would intuitively assume that their involvement on these selected activities would benefit the project's success. However, our research finds that their involvement actually suggests that user satisfaction was decreased with their involvement across all user profiles, project characteristics and company sizes. We recommend additional research in this area to understand the conditions or detailed activities where user involvement would improve user satisfaction of the completed system.

User involvement is associated with newer light weight methodologies. Light weight methodologies promote significant improvements in project performance with user involvement, but this study documents a number of contradictory findings. A comprehensive study that includes the information system development methodologies may provide insight to the key variables possibly affecting these findings.

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APPENDIX

1. Cover Letter

The following documents the original cover letter for the surveys sent electronically.

<<Full Name>> <<Date>>

<<Title>>

<<Company>>

<<Address 1>>

<<Address 2>>

<<City, State, ZIP>>

Dear <<Full Name>>,

Enclosed in this email is a link to a ten minute survey that I have developed as part of my studies in the doctoral program at Cleveland State University, Monte Ahuja College of Business. As an IS/IT project management veteran, I have focused my thesis topic around the analysis of the business user's involvement in IS projects and how this involvement impacts project performance. The results of this nationwide study will provide valuable information for both the business practitioner and IS project manager which will result in better project management communications.

Your participation in this study will be greatly appreciated, and I assure you that you will be completing this questionnaire anonymously and that you and your company will not be identifiable. The results of this study will be reported only in summary form; no mention of particular companies or participants will be given.

We will be pleased to send you a summary of the findings from this research if you will provide an email address in the questionnaire.

If you have not been personally involved in an IS project, please identify a business person within your company that has had such involvement and forward this questionnaire on to them for completion.

Thank you very much for your time and we hope to receive the completed survey within two weeks.

Sincerely,

Bradford R. Eichhorn, PMP

Doctoral Candidate

Monte Ahuja College of Business

Department of Operations and Supply Chain Management

Cleveland State University

2. Questionnaire

The following pages contain a copy of the printed survey instrument generated by Survey Monkey. 21 respondents used this paper version of the form because of their stated preference; the remaining respondents used the online version of the survey instrument.

Instructions

Identify one Information System (IS) project with which you had some level of personal involvement in the last 18 months (whether completed or still on-going).

Please provide your initial response of agreement or disagreement to each statement below by selecting the indicator that best describes your experience with respect to the one project you selected.

"System" refers to the information system product(s) delivered as a result of the IS project you selected for this questionnaire.

***1. I was involved as a business member of an IS project.**

	1 Strongly Disagree	2	3	4 Neutral	5	6	7 Strongly Agree
I was involved as a direct customer of the system.	○	○	○	○	○	○	○
I was involved as a representative on behalf of system users.	○	○	○	○	○	○	○

2. We will be pleased to send you a copy of the findings from this research if you will provide a valid email address.

(You are completing this questionnaire anonymously; you and your company will not be identifiable. The results of this study will be reported only in summary form; no mention of particular companies or participants will be given.)

Business Requirements

*3. Functional Requirements

	1 Strongly Disagree	2	3	4 Neutral	5	6	7 Strongly Agree
I defined/helped define the system processes.							
I defined/helped define the system calculations (such as sorting, filtering, totaling, percentages, and other mathematics).							
I defined/helped define the data storage requirements.							
I defined/helped define the system and user security.							
I clarified/helped clarify the task complexity.							

*4. Presentation Requirements

	1 Strongly Disagree	2	3	4	5	6	7 Strongly Agree
I defined/helped define input/output forms.							
I defined/helped define screens (layouts, complex displays, and calculations potentially including graphical representations of data).							
I defined/helped define output reports.							
I defined/helped define online queries.							

Project Activities

*5. Quality Assurance

	1 Strongly Disagree	2	3	4	5	6	7 Strongly Agree
I facilitated the use of one or more automated testing tools.							
I designed/helped design the test scripts to validate functionality.							
I executed/helped execute the test scripts to validate functionality.							
I verified system functionality by testing prototypes of the system.							

*6. Project Management

I scheduled/helped schedule portions of the project activities.							
I assisted in problem solving in the project.							
I participated in the identification, mitigation and resolution of risks and conflicts.							
I communicated with non-IS staff regarding the project's progress.							
I implemented/helped implement the system into production use.							

Project Results

*7. Project Delivery

	1 Strongly Disagree	2	3	4	5	6	7 Strongly Agree
The system was delivered within the agreed upon costs.							
The system was delivered within the agreed upon schedule.							
The system was delivered with all agreed upon scope items.							

*8. Business Functionality

The system is frequently and regularly used.							
The system delivers results in a timely manner.							
The system delivers accurate results based on the data provided.							
The system is considered to have the desired quality.							
The system provides the desired financial benefits.							
The system meets our operational efficiency requirements.							
The system is easy to use.							

*9. Technical Functionality

	1 Strongly Disagree	2	3	4	5	6	7 Strongly Agree
The system is reliably available for my needs.							
I perceive that system repairs are easy to perform.							
System functionality and performance is easy to test.							
I consider the system to be technically stable.							

Project Information

10. System Complexity (with respect to tasks, interfaces, new equipment or training required)

	Very simple	Simple	Average	Complex	Very complex
	○	○	○	○	○

11. Project Size

	0-100	101-300	301-500	501-1,000	1,001-5,000	over 5,001
($ thousands)	○	○	○	○	○	○

12. Package Installation versus Custom Development

Package Installation	Combination	Custom Development
○	○	○

13. Primary User is Employee (internal) versus Customer (external)

Internal	Combination	Customer
○	○	○

General Information

14. Gender

- ○ Male
- ○ Female

15. Age range

18-25	26-35	36-45	46-55	56-65	over 65
○	○	○	○	○	○

16. Years at your company

0-3	4-6	7-9	10-12	13-15	over 15
○	○	○	○	○	○

17. Years with Information Systems experience

0-3	4-6	7-9	10-12	13-15	over 15
○	○	○	○	○	○

*18. Title

- ○ Non-management
- ○ Middle management
- ○ Executive management
- ○ Supportive (management or non-management role supporting the project such as finance or human resource)

19. Company Size

	1-50	51-200	201-500	501-1,000	1,001-2,500	over 2,500
Number of employees	○	○	○	○	○	○

20. Industry

3. Structural Equation Mathematics

Hayduk (1987) documents the mathematics of both the measurement and structural models used in structural equation models which are summarized below. Hayduk's terminology uses "concepts" for latent variables and "indicators" for manifest variables. A cross reference between the mathematical variables, the MFUS model variables, and the specific SAS variables used in this analysis follows this in Section 3.3.

3.1. Measurement Model

The measurement model defines the relationship between the manifest (observable; measureable; exogenous) variables and their associated latent (endogenous) variables.

Equation 1: Measurement Model for Y

$$Y = \Lambda_Y \eta + \epsilon$$

where: Y is the (p x 1) vector of observed endogenous indicators

Λ_Y is a (p x m) matrix of structural coefficients

η is the (m x 1) vector of endogenous concepts

ε is a (p x 1) vector of errors

Equation 2: Measurement Model for X

$$X = \Lambda_X \xi + \delta$$

where: X is the (q x 1) vector of observed exogenous indicators

Λ_x is a (q x n) matrix of structural coefficients

ξ is the (n x 1) vector of endogenous concepts

δ is a (q x 1) vector of errors

3.2. Structural Model

The structural model describes the causal relationships between the latent variables themselves.

Equation 3: Structural Model

$$\eta = \beta\eta + \Gamma\xi + \zeta$$

where: η is the (m x 1) vector of endogenous concepts

β is an (m x m) matrix of structural coefficients

Γ is an (m x n) matrix of structural coefficients

ξ is the (n x 1) vector of exogenous concepts

ζ is an (m x 1) vector of errors

3.3. Construct Variables

This section maps the variables from the equations above to the SAS implementation of those equations (PROC CALIS). In all tables, the variable name before the parentheses represents the mathematical variable, and the variable name within the parentheses represents the SAS variable name.

Table XXV: Variables for Business Users (F1)

Independent Variable Name	Variable	Coefficient of Factor Loading	Error
Direct customer	x01 (F10)	λ01 (LNF10F2)	δ01 (VARE10)
Represent the customer	x02 (F11)	λ02 (LNF11F2)	δ02 (VARE11)

Table XXVI: Variables for Functional Requirements (F2)

Independent Variable Name	Variable	Coefficient of Factor Loading	Error
Process	x03 (F13)	λ03 (LNF13F2)	δ03 (VARE13)
Calculations	x04 (F14)	λ04 (LNF14F2)	δ04 (VARE14)
Data storage	x05 (F15)	λ05 (LNF15F2)	δ05 (VARE15)
Security	x06 (F16)	λ06 (LNF16F2)	δ06 (VARE16)
Task Complexity	x07 (F17)	λ07 (LNF17F2)	δ07 (VARE17)

Table XXVII: Variables for Presentation Requirements (F3)

Independent Variable Name	Variable	Coefficient of Factor Loading	Error
Forms	x08 (F18)	λ08 (LNF18F3)	δ08 (VARE18)
Screens	x09 (F19)	λ09 (LNF19F3)	δ09 (VARE19)
Reports	x10 (F20)	λ10 (LNF20F3)	δ10 (VARE20)
Queries	x11 (F21)	λ11 (LNF21F3)	δ11 (VARE21)

Table XXVIII: Variables for Quality Assurance (F4)

Independent Variable Name	Variable	Coefficient of Factor Loading	Error
Use of Tools	x12 (F22)	λ12 (LNF22F4)	δ12 (VARE22)
Define Tests	x13 (F23)	λ13 (LNF23F4)	δ13 (VARE23)
Execute Tests	x14 (F24)	λ14 (LNF24F4)	δ14 (VARE24)
Use Prototypes	x15 (F25)	λ15 (LNF25F4)	δ15 (VARE25)

Table XXIX: Variables for Project Management (F5)

Independent Variable Name	Variable	Coefficient of Factor Loading	Error
Schedule	x16 (F26)	λ16 (LNF26F5)	δ16 (VARE26)
Problem Solve	x17 (F27)	λ17 (LNF27F5)	δ17 (VARE27)
Risk & Conflict Management	x18 (F28)	λ18 (LNF28F5)	δ18 (VARE28)
Non-IS Communication	x19 (F29)	λ19 (LNF29F5)	δ19 (VARE29)
Implementation	x20 (F30)	λ20 (LNF30F5)	δ20 (VARE30)

Table XXX: Variables for Project Delivery (F6)

Independent Variable Name	Variable	Coefficient of Factor Loading	Error
Cost	x21 (F31)	λ21 (LNF31F6)	δ21 (VARE31)
Schedule	x22 (F32)	λ22 (LNF32F6)	δ22 (VARE32)
Scope	x23 (F33)	λ23 (LNF33F6)	δ23 (VARE33)

Table XXXI: Variables for Business Functionality (F7)

Independent Variable Name	Variable	Coefficient of Factor Loading	Error
System Usage	x24 (F34)	λ24 (LNF34F7)	δ24 (VARE34)
Timely Delivery	x25 (F35)	λ25 (LNF35F7)	δ25 (VARE35)
Accurate Data	x26 (F36)	λ26 (LNF36F7)	δ26 (VARE36)
Quality	x27 (F37)	λ27 (LNF37F7)	δ27 (VARE37)
Financial Benefits	x28 (F38)	λ28 (LNF38F7)	δ28 (VARE38)
Operational Efficiencies	x29 (F39)	λ29 (LNF39F7)	δ29 (VARE39)
Easy to Use	x30 (F40)	λ30 (LNF40F7)	δ30 (VARE40)

Table XXXII: Variables for Technical Functionality (F8)

Independent Variable Name	Variable	Coefficient of Factor Loading	Error
Reliability	x31 (F41)	λ31 (LNF41F8)	δ31 (VARE41)
Easy to Maintain	x32 (F42)	λ32 (LNF42F8)	δ32 (VARE42)
Easy to Test	x33 (F43)	λ33 (LNF43F8)	δ33 (VARE43)
Stable	x34 (F44)	λ34 (LNF44F8)	δ34 (VARE44)

4. SAS code: example

The following code is a sample of the SAS code used to evaluate the various structured equation models.

```
PROC CALIS   DATA = DissData.Responses_Merged
             CORR  RESIDUAL  MODIFICATION  KURTOSIS
             PLOTS=RESIDUALS
             OUTMODEL = Dissdata.Outmodel;
LINEQS
      NF13  = LNF13F2 F2 + E13,
      NF14  = LNF14F2 F2 + E14,
      NF15  = LNF15F2 F2 + E15,
      NF16  = LNF16F2 F2 + E16,
      NF17  = LNF17F2 F2 + E17,
      NF18  = LNF18F3 F3 + E18,
      NF19  = LNF19F3 F3 + E19,
      NF20  = LNF20F3 F3 + E20,
      NF21  = LNF21F3 F3 + E21,
      NF22  = LNF22F4 F4 + E22,
      NF23  = LNF23F4 F4 + E23,
      NF24  = LNF24F4 F4 + E24,
      NF25  = LNF25F4 F4 + E25,
      NF26  = LNF26F5 F5 + E26,
      NF27  = LNF27F5 F5 + E27,
      NF28  = LNF28F5 F5 + E28,
      NF29  = LNF29F5 F5 + E29,
      NF30  = LNF30F5 F5 + E30,
      NF31  = LNF31F6 F6 + E31,
      NF32  = LNF32F6 F6 + E32,
      NF33  = LNF33F6 F6 + E33,
      NF34  = LNF34F7 F7 + E34,
      NF35  = LNF35F7 F7 + E35,
      NF36  = LNF36F7 F7 + E36,
      NF37  = LNF37F7 F7 + E37,
      NF38  = LNF38F7 F7 + E38,
      NF39  = LNF39F7 F7 + E39,
      NF40  = LNF40F7 F7 + E40,
      NF41  = LNF41F8 F8 + E41,
      NF42  = LNF42F8 F8 + E42,
      NF43  = LNF43F8 F8 + E43,
      NF44  = LNF44F8 F8 + E44;
STD
      F2    = 1,
      F3    = 1,
```

```
    F4   = 1,
    F5   = 1,
    F6   = 1,
    F7   = 1,
    F8   = 1,
    E13  = VARE13,
    E14  = VARE14,
    E15  = VARE15,
    E16  = VARE16,
    E17  = VARE17,
    E18  = VARE18,
    E19  = VARE19,
    E20  = VARE20,
    E21  = VARE21,
    E22  = VARE22,
    E23  = VARE23,
    E24  = VARE24,
    E25  = VARE25,
    E26  = VARE26,
    E27  = VARE27,
    E28  = VARE28,
    E29  = VARE29,
    E30  = VARE30,
    E31  = VARE31,
    E32  = VARE32,
    E33  = VARE33,
    E34  = VARE34,
    E35  = VARE35,
    E36  = VARE36,
    E37  = VARE37,
    E38  = VARE38,
    E39  = VARE39,
    E40  = VARE40,
    E41  = VARE41,
    E42  = VARE42,
    E43  = VARE43,
    E44  = VARE44;
COV
    F2 F3 = CF2F3,
    F2 F4 = CF2F4,
    F2 F5 = CF2F5,
    F2 F6 = CF2F6,
    F2 F7 = CF2F7,
    F2 F8 = CF2F8,
    F3 F4 = CF3F4,
    F3 F5 = CF3F5,
```

```
    F3 F6 = CF3F6,
    F3 F7 = CF3F7,
    F3 F8 = CF3F8,
    F4 F5 = CF4F5,
    F4 F6 = CF4F6,
    F4 F7 = CF4F7,
    F4 F8 = CF4F8,
    F5 F6 = CF5F6,
    F5 F7 = CF5F7,
    F5 F8 = CF5F8,
    F6 F7 = CF6F7,
    F6 F8 = CF6F8,
    F7 F8 = CF7F8;
VAR
                        NF13  NF14  NF15  NF16  NF17  NF18  NF19
    NF20  NF21  NF22  NF23  NF24  NF25  NF26  NF27  NF28  NF29
    NF30  NF31  NF32  NF33  NF34  NF35  NF36  NF37  NF38  NF39
    NF40  NF41  NF42  NF43  NF44;
RUN;
```

5. Survey Characteristics

5.1. Sample Project Information

The following data represents the projects included in the survey data as reported by the respondents.

Table XXXIII: Project Complexity

	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Very Simple	6	3.70	6	3.70
Simple	10	6.17	16	9.88
Average	57	35.19	73	45.06
Complex	61	37.65	134	82.72
Very Complex	28	17.28	162	100.00

Table XXXIV: Project Budget

($ thousands)	Frequency	Percent	Cumulative Frequency	Cumulative Percent
0-100	43	25.60	43	25.60
101-300	23	13.69	66	39.29
301-500	22	13.10	88	52.38
501-1,000	25	14.88	113	67.28
1,001-5,000	29	17.26	142	84.52
Over 5,000	26	15.48	168	100.00

Table XXXV: Project Package

	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Package	58	35.15	58	35.15
Combination	80	48.48	138	83.64
Custom	27	16.36	165	100.00

Table XXXVI: System User

	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Internal	109	66.46	109	66.46
Combination	38	23.17	147	89.63
Customer	17	10.37	164	100.00

5.2. Sample Respondent Profile

The following data represents the survey respondents as reported by the respondents.

Table XXXVII: Gender

	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Male	125	66.84	125	66.84
Female	62	33.16	187	100.00

Table XXXVIII: Age

	Frequency	Percent	Cumulative Frequency	Cumulative Percent
18-25	4	2.37	4	2.37
26-35	23	13.61	27	15.98
36-45	45	26.63	72	42.60
46-55	62	36.69	134	79.29
56-65	30	17.75	164	97.04
Over 65	5	2.96	169	100.00

Table XXXIX: Years with the Company

	Frequency	Percent	Cumulative Frequency	Cumulative Percent
0-3	39	23.21	39	23.21
4-6	31	18.45	70	41.67
7-9	36	21.43	106	63.10
10-12	22	13.10	128	76.19
13-15	11	6.55	139	82.74
Over 16	29	17.26	168	100.00

Table XL: Years of IS Experience

	Frequency	Percent	Cumulative Frequency	Cumulative Percent
0-3	26	15.57	26	15.57
4-6	17	10.18	43	25.75
7-9	18	10.78	61	36.53
10-12	20	11.98	81	48.50
13-15	20	11.98	101	60.48
Over 16	66	39.52	167	100.00

Table XLI: Title

	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Non-management	72	42.60	72	42.60
Middle Management	66	39.05	138	81.66
Executive Management	24	14.20	162	95.86
Supportive	7	4.14	169	100.00

5.3. Sample Company Information

The following data presents information about the companies as reported by the respondents.

Table XLII: Company Size

Number of employees	Frequency	Percent	Cumulative Frequency	Cumulative Percent
1-50	16	9.47	16	9.47
51-200	13	7.69	29	17.16
201-500	15	8.88	44	26.04
501-1,000	18	10.65	62	36.69
1,001-2,500	30	17.75	92	54.44
Over 2,500	77	45.56	169	100.00

Table XLIII: Industry

	Frequency	Percent
Banking / Finance	11	5.37
Education	4	1.95
Government / Defense / Military	8	3.90
Healthcare / Pharmaceutical	24	11.71
Insurance	15	7.32
IS / IT / Telecommunications / Software	12	5.85
Logistics / Transportation / Warehousing	8	3.90
Manufacturing	26	12.68
Non-profit	4	1.95
Professional Services / Consulting	13	6.34
Real Estate	4	1.95
Retail	4	1.95
Other	17	8.29
None specified	55	26.83
	205	100.00

6. Non-Response Bias Analysis

All numerical (Likert-scale) control variables and manifest variables are analyzed between two groups of surveys divided by date (6/01/2013) to identify the presence of non-response bias. The null hypothesis is that each variable has the same mean in each group ($\mu_{early} = \mu_{late}$) therefore pooled method p-values greater than .01 suggest that they are the same.

Table XLIV: Non-Response Bias test results

Var	Name	N_{early}	N_{late}	t	p
NF10	BU direct	104	101	2.15	.033
NF11	BU Rep	104	101	-2.27	.024
NF13	F Process	99	97	-.96	.340
NF14	F Calcs	99	98	-.35	.728
NF15	F Storage	99	98	-.74	.458
NF16	F Security	99	98	.90	.371
NF17	F Complex	99	98	-.98	.326
NF18	P Forms	99	97	-.85	.396
NF19	P Screens	99	98	-.75	.457
NF20	P Reports	99	98	.09	.929
NF21	P Queries	99	97	-.62	.537
NF22	QA Tools	98	98	.03	.974
NF23	QA Design	99	98	-.63	.531
NF24	QA Execute	99	98	-.46	.649
NF25	QA Proto	99	98	-.58	.561
NF26	PM Sched	99	98	-.55	.583
NF27	PM Scope	99	98	-.83	.405
NF28	PM Risk	99	98	-1.60	.112
NF29	PM Comm	99	98	-1.55	.123
NF30	PM Impl	99	98	-1.18	.240
NF31	PD Cost	98	97	-1.28	.201
NF32	PD Sched	98	97	-1.08	.280
NF33	PD Scope	98	97	-1.56	.120
NF34	BF Use	99	97	-.97	.335
NF35	BF Results	98	97	-1.80	.073
NF36	BF Accurate	99	97	-1.20	.231
NF37	BF Quality	99	97	-1.55	.123
NF38	BF Finance	98	97	-.21	.833
NF39	BF Efficiency	98	97	-1.17	.242
NF40	BF Ease	99	97	-1.42	.158
NF41	TF Reliable	99	97	-2.49	.014
NF42	TF Repair	98	97	-1.25	.212
NF43	TF Test	98	97	-.17	.866
NF44	TF Stable	99	97	-1.13	.261
NF45	Proj Complex	92	91	-.71	.477
NF46	Proj Size	95	93	-.38	.702
NF47	Proj Package	94	92	2.00	.047
NF48	Proj User	93	92	-1.51	.133
NF49	Gender	93	94	-.26	.797
NF50	Age	95	94	.96	.340
NF51	Years Co	95	93	.80	.428
NF52	Years IS	94	93	-1.78	.077
NF54	Co Size	94	94	-1.94	.054

7. Business User Activity Analyses

Table XLV: Business User Activities

Dependent Variable / Independent Variable	Func Reqmts Low	Func Reqmts High	Present Reqmts Low	Present Reqmts High	QA Low	QA High Marginal n	PM Low	PM High
n	151	161	131	153	170	142	112	164
Functional Reqmts	1.09 ***	1.19 ***	1.04 ***	1.21 ***	1.08 ***	1.26 ***	1.05 ***	1.13 ***
Presentation Reqmts	0.89 ***	0.77 ***	0.95 ***	0.77 ***	0.89 ***	0.71 ***	0.94 ***	0.86 ***
Quality Assurance	0.58 ***	0.45 ***	0.69 ***	0.31 ***	0.58 ***	0.27 ***	0.57 ***	0.51 ***
Project Mgmt	0.70 ***	0.59 ***	0.71 ***	0.63 ***	0.70 ***	0.59 ***	0.72 ***	0.46 ***
Project Delivery								
Func Reqmts	7.27 †	5.09 *	6.60 †	10.18	6.00 **	10.03	11.14	5.50 *
Pres Reqmts	-5.07 †	-3.45 *	-5.23	- 7.01	-4.22 *	-6.91	-8.98	-4.36 *
QA	-1.21 †	-1.15 *	-0.82	- 1.42	-0.95 *	-1.45	-1.05	-1.05 *
Proj Mgmt	-1.50	-1.50 †	-0.54	- 3.78	-1.14 *	-4.10	-1.54	-0.69
Bus Functionality								
Func Reqmts	9.99 †	6.42 *	8.94 †	14.59	7.49 **	13.45	14.74	7.90 *
Pres Reqmts	-7.07 †	-4.30 *	-7.28 †	- 9.91	-5.27 **	-9.10	-11.95	-6.34 *
QA	-1.59 †	-1.34 *	-1.02	- 1.95	-1.21 *	-1.88	- 1.27	-1.41 *
Proj Mgmt	-2.03	-1.94 †	-0.60	- 5.56	-1.34 †	-5.58	- 2.03	-0.94
Tech Functionality								
Func Reqmts	10.27 †	6.15 *	9.01 †	14.96	8.10 **	13.61	13.72	7.94 *
Pres Reqmts	-7.23 †	-4.11 *	-7.23 †	-10.19	-5.71 **	-9.19	-11.01	-6.41 *
QA	-1.68 †	-1.21 †	-1.11	- 1.92	-1.29 *	-1.83	- 1.24	-1.34
Proj Mgmt	-2.19	-1.95 *	-0.70	- 5.86	-1.58 *	-5.72	- 1.95	-1.05 †
Fit: X^2 / df < 2.0	1.744	1.640	1.692	1.731	Yes	Yes	Yes	Yes
SRMSR	0.084	0.076	0.077	0.081	0.077	0.088	0.085	0.077
Parsim GFI	0.696	0.708	0.678	0.695	0.710	0.686	0.653	0.711
CFI	0.911	0.882	0.907	0.861	0.925	0.863	0.893	0.890
NNFI	0.901	0.869	0.897	0.846	0.917	0.848	0.881	0.878
|Residuals| < 2.0	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Residuals symm	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

† p < .10, * p < .05, ** p < .01, *** p < .001

8. Control Variable Analyses

Table XLVI: Project Information Analyses by Control Variable

Dependent Variable / Independent Variable	Project Complexity Low	Project Complexity High	Project Budget Low	Project Budget High	Package	Combination	Custom	Internal	Combination Marginal n	Customer
n	94	96	130	60	60	87	36	118	44	17
Functional Reqmts	1.06 ***	1.08 ***	1.07 ***	0.99 ***	1.07 ***	1.10 ***		1.07 ***	1.07 ***	
Presentation Reqmts	0.89 ***	0.91 ***	0.90 ***	1.00 ***	0.91 ***	0.88 ***		0.91 ***	0.78 ***	
Quality Assurance	0.64 ***	0.57 ***	0.63 ***	0.65 ***	0.48 ***	0.56 ***		0.60 ***	0.45 ***	
Project Mgmt	0.87 ***	0.61 ***	0.78 ***	0.52 ***	0.74 ***	0.61 ***		0.64 ***	0.91 ***	
Project Delivery										
Func Reqmts	6.52 †	9.32	6.25 *	4.78 †	17.09	4.96 *		7.06 †	- 5.33	
Pres Reqmts	-3.14	-7.57	-3.99 *	-4.58	-13.24	- 3.64 *		- 5.39 †	2.03	
QA	-1.00 †	-1.22	-1.12 *	0.19	- 1.57	- 0.81 †		- 1.00	0.29	
Proj Mgmt	-2.46	-1.17	-1.35	0.11	- 3.84	- 0.78		- 0.94	4.07	
Bus Functionality										
Func Reqmts	7.80 †	13.92	7.35 *	7.00 †	16.48	6.22 *		9.24 †	-17.70	
Pres Reqmts	-3.86	-11.28	-4.65 *	-6.83	-12.49	- 4.61 *		- 7.10 †	5.03	
QA	-1.11 †	- 1.75	-1.18 *	0.23	-1.59	- 0.86		- 1.31	1.41	
Proj Mgmt	-2.86	- 1.94	-1.65 †	0.23	- 3.63	- 0.89		- 1.26	13.97	
Tech Functionality										
Func Reqmts	7.68 †	13.78	8.35 *	6.91 †	17.86	6.56 *		10.46 †	- 7.87	
Pres Reqmts	-3.65	-11.23	-5.27 *	-6.82	-13.50	- 4.93 *		- 8.14 †	2.28	
QA	-1.15 †	- 1.63	-1.29 *	0.30	- 1.61	- 0.92 †		- 1.39	0.48	
Proj Mgmt	-2.95	- 1.95	-2.10 †	0.22	- 4.16	- 0.92		- 1.54	6.64	
Fit: X^2 / df < 2.0	6.822	1.804	1.814	4.774	1.880	1.973		1.797	1.954	
SRMSR	0.093	0.084	0.086	0.092	0.120	0.074		0.075	0.111	
Parsim GFI	0.617	0.615	0.665	0.527	0.513	0.591		0.651	0.485	
CFI	0.882	0.861	0.901	0.759	0.773	0.835		0.889	0.666	
NNFI	0.869	0.846	0.890	0.733	0.748	0.817		0.876	0.629	
|Residuals| < 2.0	Yes	Yes	Yes	Yes	Yes	Yes		Yes	Yes	
Residuals symm	Yes	Yes	Yes	Yes	Yes	Yes		Yes	Yes	

† p < .10, * p < .05, ** p < .01, *** p < .001

Table XLVII: Respondent Analyses by Control Variable – part a

Dependent Variable / Independent Variable	Male	Female	Younger	Older	Low Years at Company	High Years at Company
n	121	60	87	96	121	61
Functional Reqmts	1.07 ***	1.08 ***	1.07 ***	1.08 ***	1.08 ***	1.12 ***
Presentation Reqmts	0.90 ***	0.89 ***	0.90 ***	0.90 ***	0.88 ***	0.87 ***
Quality Assurance	0.69 ***	0.39 **	0.59 ***	0.59 ***	0.62 ***	0.52 ***
Project Mgmt	0.72 ***	0.66 ***	0.67 ***	0.73 ***	0.72 ***	0.62 ***
Project Delivery						
Func Reqmts	7.84 †	2.89 **	3.79 ***	High Std Err	3.59 ***	High Std Err
Pres Reqmts	- 5.31 †	- 2.10 *	- 2.63 **		-2.07 **	
QA	- 1.53 †	- 0.20	- 0.71 **		-0.73 **	
Proj Mgmt	- 1.52	- 0.18	- 0.51		0.74 *	
Bus Functionality						
Func Reqmts	9.98 †	3.39 **	4.40 ***		5.08 ***	
Pres Reqmts	- 6.77 †	- 2.44 *	- 3.09 **		-3.18 **	
QA	- 1.95 †	- 0.11	- 0.64 *		-0.90 **	
Proj Mgmt	- 1.78	- 0.38	- 0.50		-0.95 **	
Tech Functionality						
Func Reqmts	10.41 †	3.07 **	4.75 ***		4.77 ***	
Pres Reqmts	- 7.03 †	- 2.21 *	- 3.38 **		-2.94 **	
QA	- 2.04 †	- 0.04	- 0.69 *		-0.80 **	
Proj Mgmt	- 1.98	-0.28	- 0.61 †		-0.94 **	
Fit: X^2 / df < 2.0	1.679	1.965	1.821	1.798	1.867	1.918
SRMSR	0.075	0.090	0.085	0.085	0.083	0.098
Parsim GFI	0.660	0.538	0.607	0.613	0.646	0.535
CFI	0.910	0.756	0.861	0.863	0.886	0.781
NNFI	0.901	0.729	0.846	0.848	0.873	0.757
|Residuals| < 2.0	Yes	Yes	Yes	Yes	Yes	Yes
Residuals symm	Yes	Yes	Yes	Yes	Yes	Yes

† p < .10, * p < .05, ** p < .01, *** p < .001

Table XLVIII: Respondent Analyses by Control Variable – part b

Dependent Variable / Independent Variable	Years in IS Low	Years in IS High	Non-Mgmt	Middle-Mgmt	Exec-Mgmt	Support
n	94	106	78	70	25	10
Functional Reqmts	1.08 ***	1.05 ***	1.10 ***	1.07 ***		
Presentation Reqmts	0.87 ***	0.93 ***	0.88 ***	0.92 ***		
Quality Assurance	0.70 ***	0.55 ***	0.55 ***	0.49 ***		
Project Mgmt	0.81 ***	0.64 ***	0.68 ***	0.66 ***		
Project Delivery						
Func Reqmts	High Std Err	3.76 ***	3.81 *	-20.08		
Pres Reqmts		-3.09 **	-2.58 †	17.36		
QA		-0.28	-0.51	1.56		
Proj Mgmt		-0.30	-0.75	3.62		
Bus Functionality						
Func Reqmts		4.86 ***	6.19 *	-20.77		
Pres Reqmts		-3.91 ***	-4.30 *	18.04		
QA		-0.28	-0.87 †	1.61		
Proj Mgmt		-0.41	-1.18	3.84		
Tech Functionality						
Func Reqmts		4.98 ***	6.19 *	-20.21		
Pres Reqmts		-4.02 ***	-4.30 *	17.63		
QA		-0.20	-0.70	1.52		
Proj Mgmt		-0.48	-1.10	3.65		
Fit: X^2 / df < 2.0	6.115	1.657	1.812	1.752		
SRMSR	0.083	0.082	0.096	0.102		
Parsim GFI	0.616	0.630	0.582	0.581		
CFI	0.876	0.878	0.838	0.840		
NNFI	0.862	0.864	0.820	0.823		
|Residuals| < 2.0	Yes	Yes	Yes	Yes		
Residuals symm	Yes	Yes	Yes	Yes		

† p < .10, * p < .05, ** p < .01, *** p < .001

Table XLIX: Company Size

Dependent Variable / Independent Variable	Company Size - Small	Company Size - Large
n	75	115
Functional Reqmts	1.03 ***	1.12 ***
Presentation Reqmts	0.95 ***	0.86 ***
Quality Assurance	0.75 ***	0.46 ***
Project Mgmt	0.82 ***	0.62 ***
Project Delivery		
Func Reqmts	8.01 †	6.65
Pres Reqmts	-5.97 †	-4.96
QA	-0.94	-0.95
Proj Mgmt	-1.09	-1.32
Bus Functionality		
Func Reqmts	7.50 †	11.81
Pres Reqmts	-5.55 †	-8.94
QA	-0.93	-1.60
Proj Mgmt	-0.76	-2.57
Tech Functionality		
Func Reqmts	8.23 †	11.43
Pres Reqmts	-5.95 †	-8.70
QA	-1.05	-1.50
Proj Mgmt	-1.05	-2.54
Fit: X^2 / df < 2.0	6.687	6.175
SRMSR	0.094	0.077
Parsim GFI	0.540	0.674
CFI	0.809	0.909
NNFI	0.788	0.898
|Residuals| < 2.0	Yes	Yes
Residuals symm	Yes	Yes

† $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$

9. Reduced MFUS Model Analysis

Table L: Full MFUS Model Analysis by Job Title

	Non-Management			Middle-Management		
Hypothesized Relationship	Standardized Estimate	P-value	Supported	Standardized Estimate	P-value	Supported
H1a: BU to FR	1.10	< .001	Yes	1.07	< .001	Yes
H1b: BU to PR	0.88	< .001	Yes	0.92	< .001	Yes
H1c: BU to QA	0.55	< .001	Yes	0.49	< .001	Yes
H1d: BU to PM	0.68	< .001	Yes	0.66	< .001	Yes
H2a: FR to PD	3.81	< .050	Yes	-20.08	> .100	Inconclusive
H2b: FR to BF	6.19	< .050	Yes	-20.77	> .100	Inconclusive
H2c: FR to TF	6.19	< .050	Yes	-20.21	> .100	Inconclusive
H3a: PR to PD	-2.58	< .100	No	17.36	> .100	Inconclusive
H3b: PR to BF	-4.30	< .050	No	18.04	> .100	Inconclusive
H3c: PR to TF	-4.48	< .050	No	17.63	> .100	Inconclusive
H4a: QA to PD	-0.51	> .100	Inconclusive	1.56	> .100	Inconclusive
H4b: QA to BF	-0.87	< .100	No	1.61	> .100	Inconclusive
H4c: QA to TF	-0.70	> .100	Inconclusive	1.52	> .100	Inconclusive
H5a: PM to PD	-0.75	> .100	Inconclusive	3.62	> .100	Inconclusive
H5b: PM to BF	-1.18	> .100	Inconclusive	3.84	> .100	Inconclusive
H5c: PM to TF	-1.10	> .100	Inconclusive	3.65	> .100	Inconclusive

Table LI: Reduced MFUS Model Analysis by Job Title

	All Respondents			Non-Management			Middle-Management		
Hypothesized Relationship	Std Estimate	P-value	Supported	Std Estimate	P-value	Supported	Std Estimate	P-value	Supported
H1a: BU to FR	0.94	< .001	Yes	0.99	< .001	Yes	0.86	< .001	Yes
H1b: BU to PR	1.06	< .001	Yes	0.99	< .001	Yes	1.16	< .001	Yes
H2a: FR to PD	4.37	< .001	Yes	2.34	< .010	Yes	7.92	> .100	Inconclusive
H2b: FR to BF	5.80	< .001	Yes	3.82	< .001	Yes	8.85	> .100	Inconclusive
H2c: FR to TF	5.76	< .001	Yes	4.09	< .010	Yes	8.17	> .100	Inconclusive
H3a: PR to PD	-3.95	< .001	No	-1.89	< .050	No	-7.51	> .100	Inconclusive
H3b: PR to BF	-5.22	< .001	No	-3.23	< .001	No	-8.29	> .100	Inconclusive
H3c: PR to TF	-5.21	< .001	No	-3.51	< .010	No	-7.73	> .100	Inconclusive