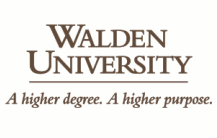

2016

The impact of technology acceptance and openess to innovaion on software implementation

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This is to certify that the doctoral dissertation by

Michael Bertini

has been found to be complete and satisfactory in all respects,
and that any and all revisions required by
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2016

Abstract

The Impact of Technology Acceptance and Openness to Innovation on Software Implementation

by

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Doctor of Business Administration, University of Phoenix, 2007

Master of Engineering Sciences, University of New South Wales, 2004

Bachelor of Engineering-Production, University of New South Wales, 1981

Dissertation Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Philosophy

Information Systems Management

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August 2016

Abstract

Senior management decisions to foster innovation and adopt new technology solutions have serious implications for the success of their organization change initiatives. This project examined the issue of senior management decision or reasons of their decision to adopt new Enterprise Resource Planning (ERP) systems as a solution to solve their business problems. This project investigated the degree that perceived ease of use and usefulness of the ERP system influenced decisions made by senior managers to innovate. Roger's diffusion of innovations theory and Davis technology acceptance model theory were used to predict when senior managers were open to innovation, and whether senior managers made decisions to adopt new technological innovations. Out of the 3,000 randomly selected senior managers of small to medium sized organizations in the United States who were invited via emails to participate, 154 completed the online survey. Binary logistic regression analysis on the collected data failed to produce statistically significant support for the claim that perceived ease of use, perceived usefulness, and openness to innovation should impact the senior manager's decision to innovate. The conclusions of this study suggest further research may include a qualitative design to gain a deeper understanding of the underlying reasons, opinions and motivations on the emotive aspects of the decision-making process in the adoption of ERP software innovations. It also offers a positive social change to stakeholders who are potentially affected by technology innovation and adoption by providing empirically validated evidence for causes of senior management technology decisions.

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Chapter 1: Introduction to the Study

Introduction

I designed this research project to examine the degree to which openness to innovation can lead to the effective implementation of enterprise research planning (ERP) software systems in small to medium business environments. For the theoretical lens of this investigation, I drew on the perspectives of diffusion of innovations theory (Rogers, 2003) and the technology acceptance model (Davis, 1989; Avci-Yücel & Gülbahar, 2013; Marangunić & Granić, 2014).

When faced with issues of implementing and/or acquiring new ERP software systems, the degree of an organization's openness to innovation should directly impact the success of the change initiative (Alghalith, 2012; Jayawickrama, Liu, & Smith, 2014; Qutaishat, Khattab, Zaid, & Al-Manasra, 2012). As such, it stands to reason that the degree to which senior managers are open to innovation will impact their decision of whether or not to innovate. It is also reasonable to assume that when an organization implements a piece of systems management technology, the perceived ease of use and perceived usefulness of the innovation will also influence senior managers' decision to innovate (Davis, 1989; Avci-Yücel & Gülbahar, 2013; Marangunić & Granić, 2014).

Although the tenets of diffusion of innovations theory and the technology acceptance model have been extensively used in previous investigations of software adoption decisions (see King & He, 2006), to date there has been no investigation that directly examines the utility of these theories in predicting whether senior managers will choose to adopt new ERP software systems in small to medium business (SMB)

environments (Avci-Yücel & Gülbahar, 2013; Davis, 1989; Marangunić & Granić, 2014; Rogers, 2003). On a theoretical level, I set about to examine the ways in which Rogers' (2003) diffusion of innovations theory can be used to help predict when senior managers will engage in deeper levels of organizational technology acceptance with ERP software systems. Along these same lines, I used the technology acceptance model (TAM) to examine how two key aspects of technology acceptance (perceived ease of use, and perceived usefulness) directly influence both the decision to innovate and openness to innovation among senior managers of SMBs.

Chapter 1 provides background information on the problem of technology acceptance as it relates to ERP implementations, as well as a statement of the problem that I investigated, and the overarching purpose and nature of the study. This chapter also includes a statement of the relevant research questions and hypotheses, and ends with a statement on the scope, assumptions, limitations, and delimitations of my investigation.

Background of the Problem

The pressure on senior management to effectively identify problems is essential to their efforts in making the right decisions to foster innovation (Murray, 2012; Winsor, 2012). In the field of ERP systems implementation management, upper management often adopts technological solutions to solve organizational problems, particularly when seeking to create information systems that are more open, flexible, and responsive to challenges (Bernroidera, Kochb, & Dtixc, 2013; Maditinos, Chatzoudes, & Tsairidis, 2012). Senior management may tend to frame the problems facing their organization solely in terms of the need to acquire newer information technology, rather than

promoting novel and innovative technological changes that would enable elements of the organization to share, interpret, and make better-informed decisions (Ruivo, Oliveira, & Neto, 2012; Xu, Rondeau, & Mahenthiran, 2011).

The management belief that they can solve problems by simply purchasing more modern technologies has deep-seated cultural roots (Nixon & Burns, 2012; Qutaishat et al., 2012; Ward, 2012). Indeed, management can overlook more critical organizational issues by focusing on the acquisition of newer technologies for the sake of having newer technology, such as the need for the technology to effectively share information (Grabski, Leech, & Schmidt, 2011; Weng & Hung, 2014). If firms do not frame their problems correctly, they will overlook the organizational aspects of change in ERP systems implementation, and negative consequences may follow (Hastie & Dawes, 2010).

The first concern is that organizations may not address how the technological innovation itself may be preventing employees from solving problems by collaborating in a flexible environment (Hastie & Dawes, 2010). The second concern is that organizations may waste investment capital when purchasing the new software and hardware that do not fundamentally address the needs of the SMB (Chiwamit, Modell, & Yang, 2014). Openness to appropriate technological innovation on the part of senior management is therefore critical if a SMB is to flourish.

It is not just openness to innovation that may drive the decision of senior management to adopt a technological innovation in a SMB environment. Technology acceptance may also play a part, especially as it is related to the perceived ease of use and perceived usefulness of the technological innovation (Avci-Yücel & Gülbahar, 2013;

Davis, 1989; Marangunić & Granić, 2014). In 1989, Davis developed the TAM as a way to show how a person's perceptions and attitudes towards a new piece of technology would predict its adoption and use. The basic principles of the TAM have been extended by a number of authors to show how the decision by senior management to adopt a new piece of technology also hinges upon organizational needs, whether they are real or perceived (Ghazizadeh, Lee, & Boyle, 2012; Venkatesh, Thong, & Xu, 2012).

Implementation decisions can cost businesses millions of dollars, and senior managers involved with improper implementation decisions can, and often do, lose their jobs as a result (Venkatesh et al., 2012). Therefore, the identification of appropriate technology implementation is critical in SMB environments, especially as related to ERP systems technology. ERP systems are often perceived as areas that favor efficiency and control in implementing organizational systems at the expense of creativity and change (De Bernardis, 2012; Ward, 2012). De Bernardis (2012) proposed that this common misconception overlooks the critical role that ERP systems can and do play in fostering and supporting innovation and entrepreneurship in SMB environments. It thus stands to reason that a senior manager's perceptions concerning the ease of use and usefulness of ERP systems software will guide their decision to adopt a technological innovation.

Problem Statement

In the field of technology, the ability of senior management to clearly and accurately define problems is essential to effectively solve them (Winsor, 2012). However, senior managers often have their problem-solving efforts occluded by their desire to obtain popular new technological products, particularly when seeking to

overhaul existing information systems in SMB environments. In their search to upgrade ERP systems software, senior management may overlook technology acceptance issues (such as ease of use and usefulness of an innovation) when purchasing ERP system upgrades by framing problems as the acquisition of new technology for the sake of new technology. In light of these issues, the specific problem that I addressed in this project was the degree to which openness to innovation might lead to the effective implementation of ERP software systems in SMB environments.

In order to effectively address the specific problem, I sought to examine factors that may increase the likelihood that senior executives will be open to innovation as a function of perceived ease of use and perceived usefulness in the implementation of new ERP systems software. Because SMBs increasingly need to adopt technological upgrades to meet rapidly changing economic problems, the proper identification of technological problems by management with ERP systems software is critical (Luftman et al., 2012). The results of this study should be helpful to executives who are faced with the need to modernize their management accounting systems, and to consultants who help clients define and address technological problems in this area.

Purpose Statement

The purpose of this quantitative correlational study was to identify conditions in which managers are more likely to correctly decide whether or not to adopt innovations relating to ERP systems. Specifically, this study set out to determine whether there is a positive relationship between the dependent variable (the decision to innovate) and the independent variables of a perceived ease of use, perceived usefulness, and openness to

innovation among the entrepreneurial business leaders of SMBs in the United States.

In order to identify factors that increase the degree to which high-level managers desire to innovate, a correlational study was conducted. Data was obtained from a survey of 154 senior management executives using SurveyMonkey, a secure on-line survey website. Survey invitations were sent to a sample of 3,000 individuals drawn from a population of 30,000 senior management executives in firms that utilize ERP systems software located in the United States. Dillman, Smyth, and Christian (2014) noted that internet-based surveys typically yield a response rate of approximately 5%. The sample of 154 executives was within this parameter.

All collected data was analyzed using SPSS version 22. Descriptive statistics were calculated for all study variables; in addition, binary logistic regression was also used to investigate the relationships among the several independent variables and the dependent variable simultaneously. The results of this study were used to design consulting services that will help clients solve problems and improve efficiency of their accounting systems.

Research Questions

In this study I set about to address the following research questions:

*RQ*1: To what extent does a senior manger's technology acceptance, as defined by perceived ease of use, influence the decision to implement ERP software innovations in small to medium business settings?

$H1_0$: Perceived ease of use of ERP software does not increase the decision to adopt ERP software.

$H1_a$: Perceived ease of use of ERP software does increase the decision to adopt

ERP software.

*R*Q2: To what extent does a senior manger's technology acceptance as defined by perceived usefulness influence his or her decision to implement ERP software innovations in small to medium business settings?

$H2_0$: As perceived usefulness of ERP software increases, the decision to adopt ERP software will either decrease or remain unchanged.

$H2_a$: As perceived usefulness of ERP software increases, the decision to adopt Enterprise Resource Planning software will also increase.

*RQ*3: To what extent does a senior manger's openness to innovation influence his or her decision to implement ERP software innovations in small to medium business settings?

$H3_0$: As openness to innovation increases, the decision to adopt ERP software will either decrease or remain unchanged.

$H3_a$: As openness to innovation increases, the decision to adopt ERP software will also increase.

*RQ*4: To what extent does a senior manager's openness to innovation channel the relationship between technology acceptance (as defined by perceived ease of use and perceived usefulness) and the decision to implement Enterprise Resource Planning software innovations in small to medium business settings?

$H4_0$: The effect of perceived ease of use and perceived usefulness on the decision to adopt Enterprise Resource Planning software is not mediated by openness to innovation.

$H4_a$: The effect of perceived ease of use and perceived usefulness on the decision to adopt Enterprise Resource Planning software is mediated by openness to innovation.

Theoretical/Conceptual Framework

In this research, I drew upon two theoretical perspectives: diffusion of innovations theory (Rogers, 2003) and the TAM (Davis, 1989; Avci-Yücel & Gülbahar, 2013; Marangunić & Granić, 2014). The primary theoretical contribution of the study to the existing body of knowledge is in showing how Rogers' (2003) diffusion of innovations theory helps to understand when senior managers will be able to correctly identify whether their ERP systems software should, or should not, be updated.

The tenets of diffusion of innovations theory should be able to accurately predict when a senior manager of a SMB is open to innovation, as well as whether a senior manager of a SMB makes the correct decision on whether to adopt a new technological innovation. A secondary theoretical contribution of this study to the extant body of knowledge is in showing how the ideas contained within the TAM influence a senior manager's openness to innovation and the decision to adopt a new technological innovation.

Definition of Terms

Double-loop learning: Organizational learning that involves "restructuring existing overall norms and behaviors instead of specific activities so that the organization develops new skills, culture, norms and behavior" (Sisaye & Birnberg, 2010, p. 341).

Enterprise resource planning systems software: A business management software package that is designed to collect, interpret, store and manage data concerning costs,

sales, inventory, shipping, and payment from business activities (Kanellou & Spathis, 2013).

First order change: Change in organizational systems that occurs within a given system which itself remains unchanged (Watzlawick, Weakland, & Fisch, 2011).

Individual innovativeness: A generalized willingness to change working practices, methods, and organizational processes (Hurt, Joseph & Cook, 1977).

Management accounting: A field that utilizes accounting information to guide decision making, and to evaluate the effects of decisions (Ward, 2012).

Organizational support for innovation: Support from formal norms and informal networks for the adoption of new working practices, methods, and organizational processes (Hurt et al., 1977).

Second order change: Change in an organizational system that changes the system itself (Watzlawick et al., 2011).

Single-loop learning: Organizational learning that focuses on more effective implementation of existing systems without changing the assumptions of those systems.

Perceived usefulness: The users' willingness to use the system based on their perception of whether the system will help them perform their job better (Davis, 1989).

Perceived ease of use: The systems usability, which needs to outweigh the effort needed to adopt, despite its perceived usefulness (Davis, 1989).

Small to medium business (SMB): The United States International Trade Commission (2011) defines a small to medium business (SMB; alternatively known as a small to medium enterprise, or SME) as having fewer than 500 employees and an annual

revenue either less than or equal to $25,000,000.

Nature of the Study

I used a quantitative, cross-sectional, correlational research design to examine the association between technological acceptance, openness to innovation, and the decision to innovate. I chose a quantitative design because the purpose of the study was to estimate the strength of the linear association between the constructs of technological acceptance, openness to innovation and the decision to innovate.

I selected a cross-sectional correlational, rather than experimental, design because my primary objective was to carry out a preliminary investigation into the associations between quantitative constructs, rather than to test causal relationships in a laboratory setting (Neuman, 2011). Given the descriptive nature of this study, an experimental investigation would be premature; for the same reason, a cross-sectional design was at this stage preferable to a more intensive and costly longitudinal study (Dixon, Singleton & Straits, 2015).

Assumptions, Scope, Limitations, and Delimitations

Assumptions

In this study I made certain assumptions about the processes of innovation in complex organizations. I assumed that the adoption of innovations is shaped largely in SMBs through the actions and intentions of senior management. Further, I assumed that the actions and intentions of senior management are constrained by cognitive processes of problem definitions that can be measured and estimated in a survey.

Scope

I invited a total of 3,000 senior management executives of SMBs to participate in the survey. The survey was restricted to participants who are part of the senior management structure of SMBs. As per the definition of the United States International Trade Commission (2011), the size of the organizations included in the study were those with less than 500 employees and that had an annual revenue of less than or equal to $25,000,000 per year. The geographical territory of the participants was restricted to the United States.

Limitations

The major limitations of the study are the dependence on self-report survey measures and my use of a cross-sectional correlational design. I relied upon participants to provide accurate reports concerning their dispositions toward adopting innovation, as well as the degree to which they report their openness to innovation. If respondents provided answers that were intended to project a socially desirable impression of themselves or their firm, or simply lack self-awareness, then the gathered self-report data would be less than accurate.

My use of a cross-sectional design further imposed limitations concerning inferences about the direction of causality between identification of the dependent variable and the independent variables in the study. Although causality can be *inferred* from a correlative study that uses survey data, causality cannot be definitively *established* in a correlative study that uses survey data (Neuman, 2011). Therefore, I was only able to show definitive associations between variables, and, as a result, will have to argue that

said associations may be causal in nature.

Delimitations

While I drew on the broader literature regarding technology acceptance and innovation diffusion, I narrowed the scope of the study to issues of how aspects of technology acceptance (i.e., perceptions of ease of technology use and usefulness of technology) influence openness to innovation and the decision to innovate with ERP systems software. I also limited focus to senior managers in SMBs, rather than middle or lower-level managers in SMBs. In addition, I focused only on solving problems that are internal to an organization, rather than ones that involve relations between organizations or broader policy issues. Finally, I limited the study to SMBs and did not focus on large firms (i.e., those companies with more than 500 employees and an revenue of greater than $25,000,000 annually).

Significance of the Study

Contribution to Business Practice

I designed this study to help decision makers become more aware of factors that promote constructive and effective identification of how to remediate problems in management accounting. The results of this study are also intended to assist consultants who work with organizations' decision-makers and executives. Consultants may become more aware of how managers may need support and coaching to effectively identify and address the decision to adopt new technological innovations with the implementation of ERP systems in SMBs.

Implications for Social Change

The results of this study may help senior managers overcome limitations in defining problems. This may help the organizations adjust to the challenges of working in a rapidly changing global economy. To address these challenges, senior managers need to go beyond choosing the correct software and hardware for traditional accounting models, and consider changes in the organization of the work place that are required for the adoptions of effective management accounting systems.

Summary and Transition

The following chapters will provide a discussion and overview of the relevant research literature and the methods that were used in this investigation. Chapter 2 examines in detail published investigations that speak to the TAM and diffusions of innovations theory. Chapter 2 also contains a more detailed discussion of how openness to innovation can lead senior managers of SMBs to adopt technological innovations, and how a senior manager's levels of technology acceptance may also play a part in the process of deciding whether to adopt a technological innovation. The research design is articulated in detail in Chapter 3. An overview of the proposed methodological approach, the instrumentation that was used, the sampling technique, the data collection strategy, and data analysis techniques are covered in Chapter 3.

Chapter 2: Review of the Literature

Introduction

The specific problem that I addressed in this project was the degree to which openness to innovation might lead to the effective implementation of ERP software systems in small to medium business environments. The purpose of this quantitative correlational study was to identify conditions in which managers are more likely to correctly decide whether or not to adopt innovations relating to ERP systems. I drew upon the perspectives of diffusion of innovations theory and the TAM to better understand of processes of how senior managers of organizations are open to innovation with the effective implementation of ERP systems in SMB environments (Avci-Yücel & Gülbahar, 2013; Davis, 1989; Marangunić & Granić, 2014; Rogers, 2003).

The main theoretical significance of the study lies in my application of Rogers' (2003) diffusion of innovation theory to understand when senior managers will engage in making correct decisions relating to the acquisition of ERP systems software. A secondary theoretical contribution lies in understanding how the process of technology acceptance among senior managers also plays a part in this process (Avci-Yücel & Gülbahar, 2013; Davis, 1989; Marangunić & Granić, 2014). Below I provide an overview of diffusion of innovations theory and the TAM.

In this chapter I offer a discussion and overview of the relevant research literature and the methods that I used in this investigation. Specifically, I examine in detail published investigations that speak to the TAM and diffusions of innovations theory. I also offer a more detailed discussion of how openness to innovation can lead senior

managers of SMBs to adopt technological innovations, and how a senior manager's levels of technology acceptance may also play a part in the process of deciding whether to adopt a technological innovation.

For the literature search, my strategy was to research peered reviewed journals and articles from relevant databases, using key search items, including their components and combinations. I used the Walden University Library, peer-reviewed search engines, professional journals and articles, relevant books, and publications for the literature search. I derived the key search terms from the 2 main theories (diffusion of innovation theory, and the TAM), the many dimensions of each theory, the terms defined in Chapter 1, innovation decision process, organizational and executive learning, and decision process for SMBs (Davies, 1989; Rogers, 2003). Over 80% of the articles I selected for inclusion were published within the last 5 years. The literature searched provided sufficient current research and articles for this study.

Diffusion of Innovations Theory

Rogers' (2003) diffusion of innovation theory suggests that the adoption of any innovation follows a bell curve, such that some individuals will consistently tend to consider and to adopt innovations before most of their peers. Diffusion of innovation theory further asserts that individuals who are more open to adopt innovations will be more open to considering the fundamental second order changes in technology adoption through the process of what is known as "double-loop learning." As Sisaye and Birnberg (2010) have noted, double-loop learning is a process that typically occurs at the organizational level and involves the "restructuring [of] existing overall norms and

behaviors instead of specific activities so that the organization develops new skills, culture, norms and behavior" (p. 341). In other words, the linkages between double-loop learning and diffusion of innovations theory can be used to show how certain types of organizations (such as SMBs) will be more likely to support and foster innovation among senior management. Thus, the propensity to recognize the need for technology adoption may be related to an organizational climate that supports innovation, as well as individual psychological dispositions. I will discuss the utility of the concept of double-loop learning within the theoretical framework of diffusion of innovations theory later in this document.

Diffusion of innovations theory was developed from research on the process through which individuals and organizations decide to adopt new technology (Rogers, 2003). Sahin (2006) reported that Rogers used the words "innovation" and "technology," which can be seen as synonymous within the theoretical framework of diffusion of innovations theory, to refer to a tool that will advance the functionality of an organization. Indeed, the very language used by Rogers in his conceptualization of diffusion of innovations theory is somewhat idiosyncratic, so much so that a brief review of key terms is warranted here.

Definitions

In his conceptualization of the diffusion of innovations theory, Rogers (2003) defined diffusion as "the process by which innovation is communicated through channels over time among members of a social system" (p. 5). Rogers further described diffusion as "the process of social change by which alteration occurs in structure and function of

the social system" (p. 6). Rogers went on to define innovation as "an idea, practice or project that is perceived as new by a change agent or other unit of adoption" (p. 12). These two definitions form the cornerstone of Rogers' theory, although they are not the only key ideas expressed in his work. For example, the ideas of adoption, uncertainty, communication channels, and the social system are also key elements.

Rogers (2003) defined adoption as the decision to fully utilize the innovation selected as the best choice for the organization. This definition is somewhat the opposite of uncertainty, which Rogers defined as an obstacle to innovation, such as lack of predictability, structure, or information. The two terms intersect insofar as the uncertainty of stakeholders regarding the adoption of the innovation process creates a situation in which they might not understand the consequences of the change initiative. One thing that helps to overcome this situation is having open communication channels, which Rogers defined as the channels in which stakeholders share knowledge and information between sources.

Finally, Rogers (2003) defined a social system as "a set of interrelated units engaged in joint problem solving to accomplish a common goal" (p. 21). It is also important to note that Rogers (2003) outlined four primary components to the diffusion of innovation process. These four components are uncertainty, communication channels, time, and social systems, each of which I discuss below.

Uncertainty. Uncertainty is the first element of the diffusion of innovations process. As previously noted, uncertainty can relate to any obstacles to the innovation process. If stakeholders in the adoption of the innovation do not understand the

consequences of the change initiative, they will be unsure on how to proceed. The consequences of uncertainty can be grouped into desirable consequences versus undesirable consequences, both of which can either be functional or dysfunctional (Rogers, 2003). Consequences of uncertainty can also be direct versus indirect, immediate versus delayed, as well as either recognized or unanticipated.

Communication channels. Communication is the second element of the diffusion of innovation process. Rogers (2003) defined communication channels as the processes in which stakeholders share knowledge and information. Diffusion is said to occur between the source of the communication and the receiver of the communication (Rogers, 2003). According to Sahin (2006), the successful diffusion of innovations is predicated upon clear and open channels of communication among participants in a social network who share similar beliefs, education levels, bias, positions and/or likes (i.e. homophily). If the participants do not share any of those attributes (i.e. they are heterophilous), the diffusion of innovation can be problematic (Sahin, 2006). Both Sahin and Rogers proposed that a significant problem in the diffusion of innovation often occurs because participants are either mostly heterophilous in nature or because they do not effectively communicate with each other.

Rogers (2003) further classified communication channels as either localite channels (i.e., those within the social system), or *cosmopolite* channels (i.e., those outside of the social system). Interpersonal channels of communication between individuals can also be either *localite* or cosmopolite, whereas mass media is cosmopolite (Sahin, 2006). Cosmopolite channels are more significant at the knowledge stage of the diffusion of

innovation process, and localite channels are more needed at the persuasion and decision stage of the innovation diffusion process (Sahin, 2006).

Time. Time is the third element of the diffusion of innovation process. Rogers (2003) noted that the progress of time in the diffusion of innovations is often either overlooked or outright ignored, even though time is an obvious aspect of all communication processes. Sahin (2006) went further to argue that the time component is the most critical factor in the diffusion of innovation process. Because time is a fundamental process in the human condition (Richet, 2012), it is often ignored; nevertheless, its presence in the process of diffusion must be acknowledged.

Social systems. The larger social system is the fourth element of the diffusion of innovation process. Rogers (2003) defined a social system as "a set of interrelated units engaged in joint problem solving to accomplish a common goal" (p. 21). Rogers argued that the social structure, which is the arrangement of the elements of the social system, and the nature of the social system will have an effect on the outcome of the individuals' innovativeness.

Innovation Decision Process

The innovation decision process includes the activities of the decision-makers to seek and process information, with the goal of eliminating uncertainty about pros and cons concerning the adoption of an innovation (Rogers, 2003). The five stages of the innovation decision process are knowledge, persuasion, decision, implementation, and confirmation (Rogers, 2003). At the knowledge stage, the change agent learns the existence of and acquires information about the new innovation (Sahin, 2006).

This is followed by the persuasion stage, in which the change agent determines whether the innovation could be positive or negative (Sahin, 2006). During the decision stage, the individual will decide to either adopt or reject the innovation (Sahin, 2006). If the decision is to adopt the innovation, the innovation is implemented, a fact which leads to the fifth and final stage. During the fifth stage, which is the confirmation stage, the individual seeks support for the innovation from stakeholders (Sahin, 2006; Rogers, 2003).

Once an innovation is adopted, the diffusion of the innovation must then take place. According to Rogers (2003), one of the problems concerning the adoption of a new innovation is the time it takes to get others to "buy in" to the adoption of the innovation. Even when the benefits are obvious, it is often difficult and/or time-consuming to get others on board with the new innovation, mainly because of any uncertainty that may be part of the adoption of the new innovation. One way to overcome the process of uncertainty is to demonstrate the relative advantage, compatibility, complexity, trial-ability, and observability of the new innovation (Rogers, 2003). Sahin (2006) asserted that these five aspects of innovation diffusion will predict the rate of adoption of the new innovation by other members within an organization.

The relative advantage attribute represents the cost or benefit of the innovation over the current state for various stakeholders (Sahin, 2006). The compatibility attribute refers to the degree the innovation can fit the existing values, people, and processes (Sahin, 2006). The complexity attribute relates to the perceived degree of difficulty of the innovation to learn or implement (Sahin, 2006). The trial-ability attribute refers to the

potential for the innovation to be tested in the environment before implementation (Sahin, 2006). The fifth attribute, observability, relates to the visibility of the innovation to outside stakeholders (Sahin, 2006). Rogers (2003) argued that innovation that offers greater relative advantage, compatibility, complexity, trial-ability, and observability has a greater chance to succeed within an organization.

Adopter Categories

It should be noted that an innovation is never adopted universally; rather, there are some people who will adopt an innovation before others (Cocklar, 2012). Rogers (2003) identified five adopter categories that are shown in Figure 1. The categories include (a) innovators, (b) early adopters, (c) early majority, (d) late majority, and (e) laggards (Keesee & Shepard, 2011). Rogers noted that while innovators are willing to investigate new ideas, it is the early adopters who are the most likely to be in leadership roles that will be in support of the new innovation.

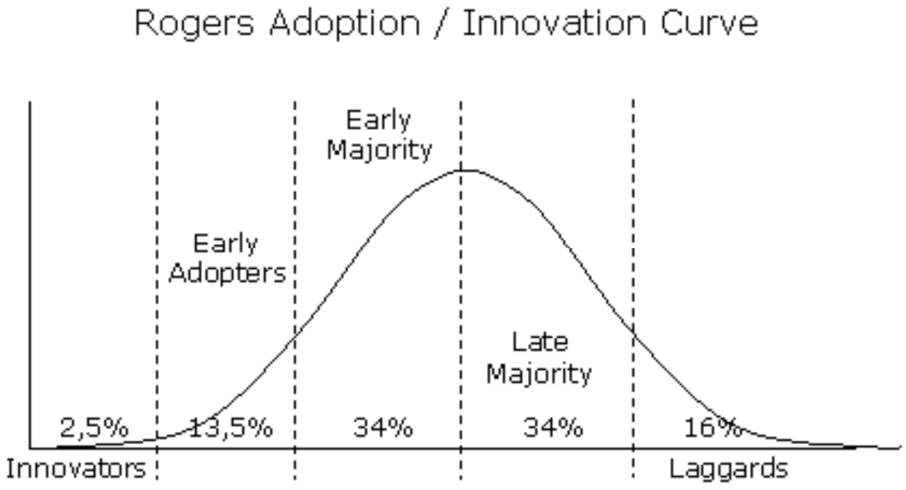

Figure 1. Rogers' (2003) adopter categorization on the basis of innovativeness.

Early majority individuals are the critical change agents in a system; it should be noted that most of these people often do not hold leadership positions (Rogers, 2003). Late majority individuals are the members of an organization who wait for the innovation to be adopted by most of the other members of the organization, and laggards are the holdout skeptics who wait to adopt an innovation until it has been proven as reliable (Rogers, 2003). The progression of adoption is depicted in Figure 1.

Innovators and early adopters tend to learn about innovations from cosmopolite sources (i.e., those sources beyond a person's local network, such as specialized media and conferences). In turn, early adopters often become the opinion leaders who foster the adoption of an innovation within an organization (Rogers, 2003). The early majority tends to depend upon local recommendations (such as word-of-mouth) and modeling of adoption by the early adopters (Rogers, 2003). The late majority will adopt an innovation only when the majority people within an organization have taken it up, and laggards will resist adoption of innovations, even when the majority has adopted and is using the innovation in question. Indeed, laggards will change only when they are compelled to by circumstances (Rogers, 2003).

These five categories also represent stable individual differences in willingness to adopt innovations. Individuals who are early adopters with one innovation are thought to be early adopters of other innovations, while those who are laggards with regard to one innovation are more likely to be laggards with regard to other innovations. A fairly substantial body of empirical research supports the notion that there are stable and

persistent differences between different levels of the adoption curve (Leite & Teixeira 2012; Manning, 2013; Pegoretti, Rentocchini, & Vittucci Marzetti, 2012).

Personal innovativeness has been found to be a stable and consistent dimension of individual differences that moderates the impact of perceptions of technological innovations on the adoption and utilization of those technologies. This finding has emerged from studies of the adoption of information technology in education, healthcare, and small business accounting software (Cocklar, 2012; Gwebu & Wang, 2011; Huang, 2013; Park & Ryoo, 2013).

The body of work on the topic has shown that early adopters can be differentiated from later adopters by a number of personal characteristics. Early adopters tend to have higher levels of knowledge and user experience, and a heightened sense that they control the outcomes of their decisions (Schreier & Prügl, 2008). In addition to these personal characteristics, early adopters may consistently be receptive to new ideas because they have a reputation to uphold as being well informed about innovation (Schreier & Prügl, 2008). Early adopters also tend to have higher levels of certain personality traits, such as extraversion and emotional stability (Svendsen, Johnsen, Almas-Sorenson, & Vitterso, 2011).

Empirical research concerning the diffusion of innovation in ERP systems software also suggests that change is more likely to occur when the leaders of organization, such as senior managers, have a general disposition toward supporting innovation, i.e. when leaders are either innovators or early adoptions (Sisaye & Birnberg, 2010). For comprehensive and sweeping change to occur in an organization that uses

ERP systems software, top management must provide leadership, resources, and support for members of the organization that champion the innovation.

These findings suggest that decision makers can be characterized as having higher or lower levels of a psychological disposition that favours the adoption of innovation. Knowledge of the relationship between the individual psychological disposition to adopt innovation and a tendency to recognize elements of organizational problems may help better predict when senior management may, and more importantly may not, be willing to adopt an innovation. That being said, different approaches to helping a client to frame organizational problems as a matter of the need to innovate may be necessary in order for clients who are generally resistive to innovation to embrace the new innovation. In order to overcome resistance on the part of the client, it is also important to recognize that organizational culture may play a part in the decision by senior management to innovate.

Organizational Innovativeness

While Rogers (2003) suggested that there are persistent individual differences in receptiveness to innovation, he also noted that organizational contexts may enhance or inhibit the adoption of an innovation on the part of senior managers of an organization. Sisaye and Birnberg (2010) suggested that second-order change and related patterns of organizational learning are more likely to occur when organizational norms and culture value and support innovation. It can therefore be argued that individual decision-makers are more likely to engage in innovative behavior in their organization when the perceived psychological climate of the organization provides support for the adoption of innovation, and for taking the risks that are often involved in the adoption of innovation (Imran,

Hasan, Rizvi, & Ali, 2011).

In addition to providing support for individual innovations, organizations can also create internal structures, such as teams, that facilitate levels of innovation that would be difficult to sustain purely by individual efforts within existing departmental structures (Liu & Phillips, 2011). The adoption of innovation requires support not only from those with formal authority in the organization, but also from informal social networks (Moore & Westley, 2011). Innovative organizations are characterized by five salient features, which include creativity, openness to new ideas, intention to innovate, risk-taking, and pro-activeness (Lynch, Walsh & Harrington, 2010).

Organizations that provide support for innovation tend to realize tangible benefits (Liu & Phillips, 2011). Researchers have found perceptions of organizational innovativeness to be correlated significantly with employees' participation in decision-making, job satisfaction, commitment, and performance (Das & Joshi, 2012; Kunz, Schmitt & Meyer, 2012; Shoham, Vigoda-Gadot, Ruvio, & Schwabsky, 2012). Cumulatively, these findings suggest that the climate of organizations can be characterized as either offering higher or lower levels of support for the adoption of innovation.

Knowledge of the relationship between the organizational support for innovation and the tendency for upper level executives to recognize elements of organizational problems may help consultants who are working with upper management in numerous ways. Consultants should be mindful that resistance to innovation, and the tendency to adopt purely technological definitions of organizational problems, are not necessarily

rooted in the psychological character of the executive; rather, the climate of the organization must also be considered. In addition, different approaches toward helping the senior managers to frame organizational problems may be needed depending on the context of organizational climate.

Factors that Promote Innovation in Management Accounting

While innovations in organizations that use ERP systems software may require changes in technological norms and organizational structures prior to the adoption of an innovation, executive decision-makers must still narrow the focus of their change efforts to making changes that leave established social regularities in place, rather than effecting needed changes (Sisaye & Birnberg, 2010). One of the consequences of defining innovation change problems in purely technological terms is that decision-makers are often trapped in a vicious cycle. When a technological innovation fails to solve an underlying organizational problem, decision-makers may look for a more effective technological innovation to take the place of the one that failed, rather than reframing the problem in ways that recognize the need for underlying changes in the norms of the organization.

A critical factor in promoting change in organizational practices in SMBs that use ERP systems software is the presence of support for innovation among the leadership of the organization, as well as its organic culture (Chenhall, 2012; Sisaye & Birnberg, 2010). To the extent that these factors support innovation, decision-makers will have more flexibility to consider alternative problem definitions that encompass innovative and technological aspects of problem definition.

Technology Acceptance Model (TAM)

This research project also draws upon the tenets of the technology acceptance model, or TAM (Davis, 1989). Two specific elements of the TAM—perceived ease of use of a technology and perceived usefulness of a technology—are applicable when seeking to understand the process of how senior managers of SMBs decide to adopt an innovate change that is needed to support the effective implementation of ERP systems software. The theoretical relevance of the TAM rests upon the understanding that the perceptions of senior managers hold towards the implementation of ERP systems software are antecedent to the willingness of senior managers to innovate.

Attitudes held by senior managers concerning the usefulness and ease of use of a technological innovation will directly impact a senior manager's openness to innovation, as well as his or her decision to innovate. Thus it can be argued that the ideas contained within Rogers' (2003) diffusion of innovations theory might be improved through the incorporation of aspects of the TAM as articulated by Davis (1989). In order to better understand this line of thought, a thorough exploration of the TAM is in order.

Technology Acceptance Model Theoretical Foundations

One of the main aspects of technology is that it is always evolving and changing. The fast-paced evolution of technology is best illustrated by the axiom known as "Moore's Law," which essentially states that most forms of technology (such as computers) will double in complexity approximately every 24 months (Mack, 2011). Yet

the fast-paced evolution of technology can be a problem for end-users of that technology, as they must choose to adopt the new technology, squeeze more life out of existing technology, or be left behind in the marketplace (Venkatesh et al., 2012). When technology failures occur, millions of dollars can be lost, and the senior managers responsible for the failures associated with technology implementation can, and often do, lose their jobs as a result (Venkatesh et al., 2012).

It has been suggested through use of the TAM (Davis, 1989) that two perceptions and attitudes about a particular technology (such as a piece of hardware or software) can accurately predict whether or not said particular technological innovation will, or will not, be successfully adopted by an organization. Indeed, it was Davis who first demonstrated via the ideas of the TAM that the perceptions and attitudes of end users will reliably predict or explain successful technological adoption and use.

The TAM is theoretically couched in the intellectual intersections of the theory of reasoned action and the theory of planned Behavior (Yousafzai, Foxall, & Pallister, 2011). In short, the theory of reasoned action essentially states that a behavioral intention (an attitude or cognition) will dictate a subsequent voluntary action (Yousafzai et al., 2011), whereas the theory of planned behavior examines how the determinants of the decision-making process will lead to the formation of attitudes that subsequently guide behaviors (Yousafzai et al., 2011). Aspects of both the theory of planned behavior and the theory of reasoned action were used in the TAM by Davis (1989) to illustrate how attitudes towards technology will guide a person's behavioral decisions concerning acceptance and usage of said technology.

The TAM has been used with a surprising degree of accuracy to show how attitudes on the part of technology users will predict whether or not the user will accept or reject a new technology. Studies have shown that there is a strong relationship between the perceptions of users towards a given technology and their actual use of the given technology (Qutaishat, et al., 2012; Venkatesh et al., 2012). It has been suggested that what drives the relationship between perceptions and actions in the TAM is an underlying cost-benefit analysis, similar to what is found in behavioral decision theory (Bromiley & Rau 2011; Powell, Lovallo & Fox, 2011; Takemura, 2014).

During the decision-making process, individuals will decide on whether or not to adopt a given technological innovation based on the different options between the decision to adopt and the resulting outcome of that decision (Bromiley & Rau 2011; Powell et al., 2011; Takemura, 2014). In other words, the perceived ease of use and perceived usefulness of a new technological innovation will guide the subjective cost-benefit analysis associated with adoption of a new technology on the part of an end-user. This last point is of great importance, as the two aspects of the TAM that are critical in determining whether a person will adopt a new piece of technology are the perceived ease of use of the technological innovation and the perceived usefulness of the technological innovation (Davis, 1989; Avci-Yücel & Gülbahar, 2013; Marangunić & Granić, 2014; Venkatesh et al., 2012).

Perceived Usefulness

Perceived usefulness is the first dimension of the TAM. Davis (1989) defined perceived usefulness as a user's willingness to engage with the new technology. The

willingness of the user to engage is based on their attitudes towards whether the new technology will help them to perform their assigned tasks better. Davis specified that users see usefulness of the new technology as a blend of whether the technological innovation will help them to do their job more effectively, will increase their productivity, and will save them time. Davis (1989) and other authors have shown that perceived usefulness is the predominant variable in determining whether a person will decide to accept a new technological innovation (Venkatesh et al., 2012).

Perceived Ease of Use

Perceived ease of use is the second of the two dimensions of the TAM that govern whether an end-user will adopt a technological innovation. Davis (1989) defined perceived ease of use simply as a system's utility. Davis further proposed that a system's utility needs to outweigh the effort required in adopting it, despite its perceived usefulness. Davis classified the research items for perceived ease of use into three main clusters: physical effort, mental effort, and the direct perception of how easy a system is to use.

Research has shown that ease of use and ease of learning are strongly related (Davis, 1989; Venkatesh et al., 2012). According to Davis (1989), ease of use of a new system is associated with the learning process and is therefore subject to both the ease of use of documentation and the system guidelines. Lin, Liu and Kuo (2013) proposed that ease of use and ease of learning are congruent, as they are not separate or disjointed activities. The easier the system is to use, the more apt the individual is to learn the system by using the system rather than referring to the user manuals or available training

provided (Lin et al., 2013).

Davis (1989) and subsequent researchers have suggested that perceived ease of use is the weaker variable in determining technology acceptance than perceived usefulness (Venkatesh et al., 2012). No matter how easy to use a new technology is, a user tends to accept the technology more on the basis of a needed function for the individual or the organization. Nevertheless, both perceived ease of use and perceived usefulness have been shown in the literature to guide the decisions of people when it comes time to implement a new technological innovation.

Integrated Theoretical Model

In this dissertation I set about to merge the ideas contained within diffusion of innovations theory by Rogers (2003) with the ideas contained within the technology acceptance model by Davis (1989) when seeking to articulate the conditions in which senior managers of SMBs will correctly decide whether or not to adopt innovations relating to ERP systems software. To this end, I hypothesized that perceptions concerning ease of use and usefulness of ERP systems software on the part of senior managers will directly influence a senior manager's openness to innovation and his or her decision to adopt a new ERP systems software innovation in SMBs. I also hypothesized that openness to innovation will serve as a mediator for the impact that perceptions concerning both ease of use and usefulness will have on a senior manager's decision to innovate. These hypothesized theoretical linkages are detailed in Figure 2.

Although Figure 2 explicates the main theoretical elements that I investigated in the current project, other variables, ideas, and theoretical considerations will impact the

conditions under which senior managers of SMBs will make correct decisions concerning whether or not to adopt innovations relating to ERP systems. An overview of these ideas, variables, and considerations is therefore in order.

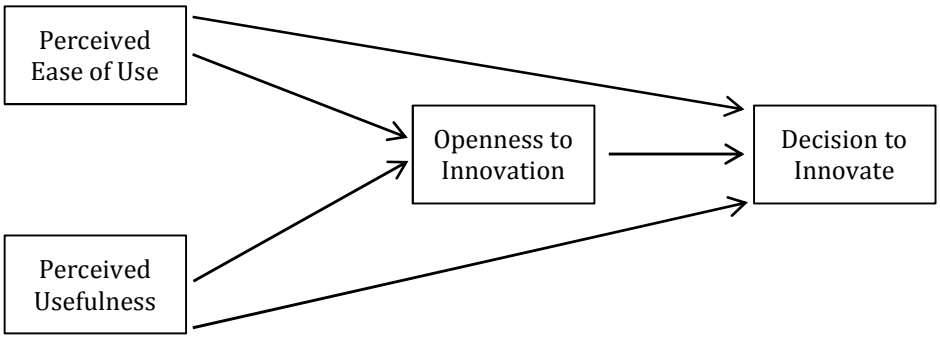

Figure 2. Proposed investigatory model.

Adoption of Technology and Social Innovation

Social and technological innovation in ERP systems software can be viewed within the broader literature of innovations in organizational development and information systems. It is important to recognize that the adoption of technology is not an impersonal process; rather, the transfer of technology from innovators to industry depends heavily on networks of social relationships (Cheng & Chen, 2013; Lee, 2012), particularly when the optimal use of an innovation is predicated upon tacit knowledge that is not easily communicated in documentation. One example of this can be found in research conducted in the healthcare field. When evidence-based innovations in healthcare become widely known within patients' social networks (i.e., outside of traditional healthcare delivery systems), they gain the potential to disrupt established patterns of transacting business (Clavier, Senechal, Vibert, & Potvin, 2012; Rotheram-Borus, Swenderman, & Chorpita, 2012). Indeed, several very effective medical

treatments today are not widely utilized by practitioners due to social and organizational limitations in scaling up and sustaining adoption of said innovations (Glasgow et al., 2012; Scheirer & Dearing, 2011).

This example from the healthcare field shows how the adoption of technological innovation in any business setting can be used to reinforce existing organizational structures or to support fundamental changes in the social organization of organizational structures. In the latter case, a firm understanding of the nature of social innovations is needed to ensure that the correct technological innovations are adopted. Illustratively, cloud-computing technology supports fundamental changes in organization and practice of occupational health (Paton, 2012). This relatively new technology has supported changes in the roles of occupational health providers who now need to be increasingly mobile in the field and to collaborate with practitioners in related areas of healthcare. Cloud computing has also been used in the healthcare field for storing patient information so that it is more widely available to occupational health practitioners and their colleagues. The qualities of omnipresence and collaborative support, found in the example of public health, have been also cited as major factors supporting the adoption of cloud computing to support distance education and other organizational innovations in higher education (Park & Ryoo, 2013).

A recurrent theme in the discussion of the role of technology in social innovation (regardless of sector of the economy) is the way in which social and organizational goals drive the adoption of technology, and are not merely by products that follow from technological change. In the healthcare examples offered above, an understanding of

needed changes in social norms and organizational structures often drives the selection and adoption of technology. In the field of management accounting, innovations are similarly scoped, as they often involve mutually reinforcing changes in technology and in social organization. Examples of widely adopted innovations in ERP systems software illustrate how these adoptions are dependent in part on changes in norms within an organization (Chenhall, 2012; Chenhall, Kalunki & Silvola, 2011). Illustrative examples of accounting innovations that required changes in social organization include the use of benchmarking to measure the performance of local government organizations, and activity based costing and activity based management (Sisaye & Birnberg, 2010; Siverbo, 2014). In each of these areas, the adoption of a new technological innovation by an organization involved changes in the way in which information was shared among actors in the organization, and changes in the degree to which managers at all levels of the organization were accountable to measurable results based on such information.

Additional Factors that Impact Decision to Innovate in SMBs

Type of Business

As noted by Sisaye and Birnberg (2010), the process of double-loop learning involves the adoption of more fundamental change in the structure of an organization, typically under the leadership of a senior figure in the organization who serves as an advocate for management accounting. Leadership is thus a key factor that tends to support the efforts of the management advocate, and makes the organization more conducive to efforts to change rather than preserve traditional norms and organizational patterns.

In the present study I have drawn on the tenets of diffusion of innovations theory (Rogers, 2003) to illustrate the process used in determining which innovations will be implemented effectively. I also drew upon studies in which the researchers have found that organizations often need to change their internal organization in ways that promote more flexible collaboration in order to effectively implement ERP software systems. At the same time, cultural practices, cognitive biases, and an aversion to innovation may lead decision-makers to become attached to technological solutions for problems in their organizations. By persisting with a narrow focus on technological solutions, decision-makers may enter a trap in which they persevere in single-loop learning, and repeatedly adopt first order changes that are designed to maintain existing relations and norms in the organization rather than change (Sisaye & Birnberg, 2010).

Argyris and Schön (1978) suggested that organizations are constantly striving to reduce the gap between expected and achieved ends. When errors or discrepancies are detected between the intended or expected outcome, and the actual consequences of an action, organizations will change their action strategies to minimize this gap. Efforts to reduce this gap may result in single-loop or double-loop learning. In single-loop learning, decision-makers look for another action strategy that is consistent within established governing parameters and acceptable limits. Single-loop learning involves looking for a more efficient method for carrying out routines and procedures that have been accepted within the organization.

When problems prove not to be amenable to single-loop learning, organization members may engage in double-loop learning. In this form of learning, the governing

parameters themselves are open to scrutiny, and basic assumptions about framing the problems facing the organization may be challenged. Argyris & Schön (1978) characterized the difference between single and double-loop learning in the following way:

> When the error detected and correction permits the organization to carry on its present policies or achieve its present objectives, then that error-and-correction process is *single-loop* learning. Single-loop learning is like a thermostat that learns when it is too hot or too cold and turns the heat on or off. The thermostat can perform this task because it can receive information (the temperature of the room) and take corrective action. *Double-loop* learning occurs when error is detected and corrected in ways that involve the modification of an organization's underlying norms, policies and objectives. (Argyris & Schön, 1978, pp. 2-3)

In many organizations, single-loop learning focuses on adopting technological solutions that leave existing organizational processes (governing variables) unchanged, while double-loop learning leads to consideration of ways in which the organization of the workplace can be changed.

In the field of management accounting, the concepts of single- and double-loop learning have been used to understand the ways in which organizations undertake the changes in norms and organization that are needed to effectively implement ERP systems software innovations. Sisaye and Birnberg (2010) suggested that single-loop learning leads organizations to learn a more efficient way to implement existing financial accounting practices, rather than to fully adopt ERP systems software innovations. In

contrast, double-loop learning promotes transformational rather than incremental change with the adoption of any ERP systems software innovations. Sisaye and Birnberg (2010) proposed that in double-loop learning, "adaptation may involve restructuring existing overall norms and behaviors instead of specific activities so that the organization develops new skills, culture, norms and behavior" (p. 341).

By using ideas couched within Sisaye and Birnberg's (2010) broader framework, I should be able to recognize that an essential prerequisite for double-loop thinking is predicated upon recognition of organizational issues in the implementation of the diffusion of innovations. Failure to recognize problems within an organizational structure on the part of senior management will perpetuate single-loop thinking about how organizations need to adopt innovations. According to Sisaye and Birnberg (2010), prominent factors that encourage senior managers to recognize the need for the adoption of innovations include having a member of upper management act as an advocate for the adoption of an innovation, as well as having organizational norms that foster openness and receptivity to change. Sisaye and Birnberg's framework also suggests that managers are more likely to identify needs for the adoption of innovations if a manager is an advocate for innovation who works in an organization that supports said innovation.

When brought together, the ideas of Argyris and Schön (1978), Sisaye and Birnberg (2010), and Rogers (2003) can be used to predict how single- and double-loop learning will impact the decision to innovate on the part of senior managers of SMBs (Argote, 2011; García-Morales, Jiménez-Barrionuevo, & Gutiérrez-Gutiérrez, 2012). This is because single-loop learning may be favored by managers who are reluctant to

consider the type of systemic change that is required for the adoption of a new innovation. In the context of management accounting, double-loop learning is often needed, as changes in the norms and organizational structure of a firm are needed when purchasing software or other technological changes for an organization.

Impediments to Organizational Learning

Defining both learning and organization is important to the current discussion. Brown, Roediger, and McDaniel (2014) defined learning as a process resulting from an experience in which an individual's knowledge is permanently changed. Jiménez-Jiménez and Sanz-Valle (2011) suggested that learning is a process that involves taking in information to increase experience, and as a result, to modify knowledge, new skills, or new competence. Weick (2013) defined an organization as a group of two or more people who (a) share collective goals, (b) are in some type of cooperative agreement, (c) have a division of labor, and (d) have a hierarchical structure.

According to Schilling and Kludge (2009), four psychological processes (known collectively as the 4I framework) can be used to categorize barriers to organizational learning. These include (1) intuiting, which relies on personal experiences to create new insights; (2) interpreting, which is the individual describes his or her insights to others; (3) integrating, which is the group integrates the individuals' insights into action; and (4) institutionalizing, which can be described as the actionable insights are implemented into procedures, processes, systems, strategies and policies.

The 4I model can be used to better understand barriers to organizational learning. Intuiting barriers include employee biases, employee deficiencies, lack of understanding

of failure analysis, lack of motivation, high level of stress, lack of measurable goals, strict or perceived rules and regulations, complex competitive market, and difficult knowledge acquisition (Kowta Sita & Chitale, 2012; Lucia, Leda & Silvia, 2012; Schilling & Kludge, 2009). Interpretation barriers include fear of loss of ownership, lack of political and social skills, low confidence, and conflicting relationship with group, failure avoidance, a culture of silence, and conflict avoidance (Smith, 2012).

Integrating barriers include fear of team disadvantage and potential negative repercussions; lack of authority, leadership support, participation, and recognition; outdated core organizational and individual beliefs; inconsistent vision at different levels of the organization; employee competition; low management turnover; long-term organizational structure; and gap between innovation and organization's rituals (Schilling & Kludge, 2009). Institutionalizing barriers include innovation perceived irrelevance; lack of innovation implementation skills and time, laissez-faire management style, cynicism, fear of change, loss of power, and cultural differences (Schilling & Kludge, 2009). These 4I framework barriers to implementing organizational learning can be summarized as lack of trust in the innovation, deficient skills to implement improvements; lack of change-management skills; and resisting, counteracting, biased, and opportunistic behavior.

Summary and Transition

This chapter provided the theoretical context to the problem of adopting

innovations, and a statement of the problem that will be addressed in this research. The purpose and nature of the study was stated, and relevant empirical and theoretical literature was reviewed. The next chapter will describe the methods and data analyses that were employed to address the research questions that were stated in Chapter 1.

Chapter 3: Methodology

Introduction

In this project I set about to investigate whether openness to innovation will lead to the effective implementation of ERP software systems in SMB environments in the United States. The primary purpose of this study was to determine if a senior manager's decision to innovate is influenced by that manager's openness to innovation, perceptions concerning the ease of use of new technology, and perceptions concerning the usefulness of new technology. In order to properly investigate the research questions, I used a quantitative correlational methodological approach (Neuman, 2011) for all data collection and data analyses.

In this chapter, I present an overview of the methodological design, as well as information on the sampling process, sampling procedures, data collection, data analysis, and all ethical safeguards that I employed. I also offer an explanation of the instrumentation that I used in this project.

Research Design

I used a quantitative method for all data collection and data analysis. More specifically, I used a quantitative correlational methodological approach (Neuman, 2011) to investigate the tenets of the four main research questions. My choice of the research design was predicated in part on the fact that all data was gathered via the use of an electronic survey. Neuman (2011) noted that a quantitative approach uses procedures to investigate questions such as experiments and surveys with the intent to statistically analyze any and all collected data.

Because I used a survey technique to gather statistical data, my use of a quantitative correlational methodological approach is sound (Neuman, 2011). A quantitative correlational methodological approach is also appropriate for this study, considering that I used a random sample (Neuman, 2011) as part of the data collection technique. Finally, because I collected numeric data, that data needed to be analyzed quantitatively. For this study, I used multivariate binary logistic regression as the primary analysis tool to discover if relationships exist among the several independent variables and the dependent variable in this study.

As Agresti and Franklin (2013) proposed, binary logistic regression is the correct analysis technique to use when one has a single dependent variable and multiple independent variables. Agresti and Franklin (2012) further noted that binary logistic regression requires a dependent variable that is measured as a dichotomous nominal-level indicator, a condition that is satisfied in the current analysis scenario. As such, I used binary logistic regression to investigate the research questions below.

Research Questions and Hypotheses

This study addresses the following research questions:

*RQ*1: To what extent does a senior manger's technology acceptance, as defined by perceived ease of use, influence the decision to implement ERP software innovations in small to medium business settings?

$H1_0$: Perceived ease of use of ERP software does not increase the decision to adopt ERP software.

$H1_a$: Perceived ease of use of ERP software does increase the decision to adopt

ERP software.

*R*Q2: To what extent does a senior manger's technology acceptance as defined by perceived usefulness influence his or her decision to implement ERP software innovations in small to medium business settings?

$H2_0$: As perceived usefulness of ERP software increases, the decision to adopt ERP software will either decrease or remain unchanged.

$H2_a$: As perceived usefulness of ERP software increases, the decision to adopt Enterprise Resource Planning software will also increase.

*RQ*3: To what extent does a senior manger's openness to innovation influence his or her decision to implement ERP software innovations in small to medium business settings?

$H3_0$: As openness to innovation increases, the decision to adopt ERP software will either decrease or remain unchanged.

$H3_a$: As openness to innovation increases, the decision to adopt ERP software will also increase.

*RQ*4: To what extent does a senior manager's openness to innovation channel the relationship between technology acceptance (as defined by perceived ease of use and perceived usefulness) and the decision to implement Enterprise Resource Planning software innovations in small to medium business settings?

$H4_0$: The effect of perceived ease of use and perceived usefulness on the decision to adopt Enterprise Resource Planning software is not mediated by openness to innovation.

$H4_a$: The effect of perceived ease of use and perceived usefulness on the decision to adopt Enterprise Resource Planning software is mediated by openness to innovation.

Setting and Sample

The population that I used for this investigation consisted of senior management executives in SMB firms that utilize ERP systems software in the United States. Senior management executives who were at least age 18 were invited to participate in the study. I generated a sampling frame of 30,000 email addresses of senior management executives, and used a simple random sample from this sampling frame to identify the 154 individuals selected into the sample. Dixon et al. (2015) defined simple random sampling as a situation where "every possible combination of cases has an equal chance of being included in the sample" (p. 159). Dixon et al. went on to propose that simple random sampling is the preferred probability sampling technique for selecting a sample that is representative of the population in question, as it is the technique most likely to satisfy the condition of true randomness in the selection process.

I expected that a random sampling of 10% of the sampling frame would yield a sufficient number of respondents to ensure that at least 154 viable surveys were returned. Dillman et al. (2014) noted that internet-based surveys typically yield a response rate of approximately 5%; given this information, it stood to reason that a random sample of 3,000 executives would result in approximately 150 completed surveys. I obtained a final sample of 154 completed surveys, which was sufficient for the statistical analysis portion of the project. A G*Power analysis (Faul, Erdfelder, Buchner, & Lang, 2009) suggested that this sample size should be adequate. As part of the G*Power calculation, an alpha

level of 0.05, a statistical power of 0.95, a conservative effect size of 0.10 and a two-tailed approach for a regression analysis with 15 predictors was assumed. The resultant G*Power calculation with these parameters suggested that the minimum sample size should be 133 respondents. Thus the final sample of 154 respondents exceeded the minimum sample size needed to detect statistically significant effects in the multivariate binary logistic regression analysis.

Measures

Dependent Variable

The dependent variable in this investigation was whether or not each participant in the study made the correct decision concerning the adoption of a new technological innovation. The question that I used to derive this information was, "In your professional opinion, should Rockhampton Drapers proceed with the purchase of the new software?" I coded responses for this question as either "made correct decision to innovate" or "made incorrect decision to innovate." The decision to innovate was ultimately based on a respondent's decision after reading and considering one of four scenarios linked to the above question.

I constructed four scenarios (see Appendix A for a complete detailing of each of the four scenarios) as a way to determine whether or not each respondent made the correct decision regarding the adoption of a new technological innovation. Each respondent was randomly assigned to one of the four scenarios, and each scenario asked participants to consider whether a fictional company should upgrade its ERP systems software.

Atzmüller and Steiner (2010) noted how the use of vignettes is widely seen as a way of obtaining both valid and reliable data concerning opinions, attitudes, and beliefs. In this study, I used the vignettes to ascertain a respondent's decision to innovate. I designed the four scenarios to be identical in terms of the overall content. There were five factors in each scenario that I modified to provide variability within each vignette. These five factors are as follows:

1. The age of the current software (either two years old or thirty years old).
2. Customer satisfaction (customers are either happy or unhappy).
3. Projected increase in growth after technology adoption (either four percent or twenty-three percent is projected).
4. Projected reduction in inventory turns (either three percent or seventeen percent is projected).
5. Cost of upgrade as a percent of annual revenue (either two percent or fifteen percent).

It should be noted that scenario 1 and 2 (see Appendix A) are polar opposites in that all five factors in scenario 1 are set so that the correct decision is to not purchase the new software (i.e., do not adopt the innovation), whereas the five factors in scenario 2 are set so that the correct decision is to purchase the software (i.e., adopt the innovation). I set the five factors in scenarios 3 and 4 (see Appendix A) so that the correct decision would be harder to ascertain on the part of the respondent. In these scenarios, I set three of the five factors in one direction, and the other two factors in the opposite direction. For scenario 3, the correct decision is to adopt the innovation, as three of the five factors had

been set in that direction. For scenario 4, the correct decision is to not adopt the innovation, as three of the five factors had been set in that direction.

It should be noted here that each of the four scenarios had three questions that were posed to respondents after they had read a given scenario. I used Questions 1 and 2 as red herrings to distract from the information presented in Question 3. It should also be noted here that I constructed the scenarios from real-world issues facing organizations that are using ERP systems software.

Independent Variables

This investigation used three focal independent variables: openness to innovation; perceived usefulness; and perceived ease of use. Each of these variables is described below.

I measured the variable openness to innovation via the Individual Innovativeness (II) scale developed by Hurt et al. (1977). The original version of the II scale is a 20-item questionnaire that measures a person's willingness to change, or in other words, a person's degree of innovativeness (Hurt et al., 1977; Pallister & Foxall, 1998). Questions that are part of this scale include items such as "I seek out new ways to do things" and "I am receptive to new ideas." Response categories for this scale are on a five-item Likert scale that ranges from a low of "Strongly Disagree" to a high of "Strongly Agree." An investigation of the psychometric properties of the II scale by Hurt et al. and Pallister and Foxall yielded high reliability scores of between .86 and .90, as well as acceptable discriminant validity of the measurement instrument. A 10-item shortened version of the scale is also available for use, and this shortened version has demonstrated a high level of

validity and acceptable reliability (Pallister & Foxall, 1998). Based on this assessment, the 10-item version of the scale was used in this study.

The variable perceived usefulness was measured via the perceived usefulness (PU) scale developed by Davis (1989) as part of the TAM. The PU scale is a six-item scale that is designed to evaluate "the degree to which a person believes that using a particular [technology] would enhance his or her job performance" (Davis, 1989, p. 320). Questions that are part of this scale include items such as "using (ITEM) would improve my job performance" and "I would find (ITEM) useful in my job." Response categories for this scale are on a five-item Likert scale that ranges from a low of "Strongly Disagree" to a high of "Strongly Agree." The PU scale has been shown to have high reliability scores across multiple studies (for a review, see Hess, McNab, & Basoglu, 2014). Convergent and discriminant validity of the instrument was also established in two separate investigations by Davis (1989) and Adams et al. (1992) through the use of a multitrait, multimethod evaluation technique.

The variable perceived ease of use was measured via the perceived ease of use (PEU) scale that was also developed by Davis (1989) as part of the TAM. The PEU scale is a six-item scale that is designed to evaluate "the degree to which a person believes that using a particular [technology] would be free of effort" (Davis, 1989, p. 320). Questions that are part of this scale include items such as "learning to operate (ITEM) would be easy for me" and "I would find (ITEM) to be flexible to interact with." Response categories for this scale are on a five-item Likert scale that ranges from a low of "Strongly Disagree" to a high of "Strongly Agree." The PEU scale has been shown to

have high reliability scores across multiple studies (for a review, see Hess et al., 2014). Convergent and discriminant validity of the instrument was also established in two separate investigations by Davis (1989) and Adams et al. (1992) through the use of a multitrait, multimethod evaluation technique.

Statistical Controls

Several variables were used as statistical controls because of their potential to confound the relationships between the focal independent variables and the dependent variable. These variables include demographic factors (such as the respondent's age, gender and educational attainment) and information on the nature of the SMB where the respondent works (such as whether the SMB engages in internet-based commerce and the number of employees at the SMB). A complete list of all statistical controls to be employed by this investigation can be found in Appendix A.

Data Collection and Data Analysis

I collected data via an online survey that was programmed into SurveyMonkey. Appendix A contains the content of the survey that was programmed into SurveyMonkey. Appendix B contains a final version of the same survey. In order to ensure that at least 150 senior executives at SMBs participated in the online survey, survey invitations were sent via email to the 3,000 individuals who were randomly selected into the sample. In order to maximize the response rate of the survey, a three-push email contact method was utilized. The three-push email contact method is also known as the Dillman Tailored Design Method (Dillman et al., 2014). This method sends an initial invitation email to all potential respondents in a sample. The invitation email

contained information on the nature of the survey and a link to the online survey. After one week elapsed, all potential respondents who did not respond to the first email survey were re-contacted via a second invitation email. The second invitation email again contained information on the nature of the survey and a link to the online survey. The second email also contained additional information regarding how important it is for the respondent to participate in the survey. After an additional week had elapsed, all potential respondents who did not respond to the first or second survey were sent a final invitation email. As before, the third email contained information about the survey and a link to the survey. The third email also contained notification that the final email was the last opportunity for the respondent to participate in the survey. All data collection was suspended one week after the final email was sent.

Once I collected the data, I subjected it to two separate data analysis strategies via the statistical program SPSS, version 22. The first data analysis strategy involved the calculation of descriptive statistics, such as means, medians, modes, and standard deviations (as appropriate). Descriptive statistics elucidate the basic patterns and trends within the data (Agresti & Franklin, 2012). The second data analysis strategy that I used was binary logistic regression. I used this technique to investigate whether the propensity of senior executives to make the correct call concerning the adoption of an innovation is predicted by the focal independent variables (i.e., openness to innovation, perceived usefulness, perceived ease of use), net of the statistical control variables. As previously stated, binary logistic regression is the appropriate analysis technique to use with a dependent variable that is a dichotomous nominal-level indicator and one or more

independent variables (Agresti & Franklin, 2012).

Ethical Protection of Participants

I distributed invitations to participate in the online survey to all potential respondents via email. Embedded within the invitation email was a link to the online survey at the SurveyMonkey website. Respondents were allowed to anonymously log into the survey, thus providing the ethical assurance of anonymity of responses. No information was recorded in the survey that could potentially link a respondent's email address to his or her responses on the survey. Prior to starting the survey, respondents were presented with an embedded consent form (see Appendix C for a copy of this consent form). At the end of the consent form was a question that asked potential respondents if they wished to make a voluntary and informed decision to participate in the survey. Respondents selecting 'no' were directed to the final page of the survey and thanked for their time. Respondents selecting 'yes' proceeded to the first page of the survey.

All data obtained via the online survey was de-identified data, which means that I was not able to link a respondent with his or her data. After the survey was finished, I removed the data from the SurveyMonkey server and transferred to my personal laptop computer. Once the data was removed from the SurveyMonkey server, I deleted the data from the server. I subsequently kept all data on a password-protected laptop computer owned by me. The laptop was stored in a locked cabinet at all times when not in use. Only I knew the password to the laptop computer, and only I had a key to the locked cabinet. All data in Chapter 4 will only be reported in aggregate, which means that no

data on an individual respondent will be reported. Upon completion of this dissertation project, I will erase all data from the hard drive of my laptop computer in accordance with proper IRB procedures.

Summary and Transition

The methodology chapter outlined the process of how participants were selected, along with the data collection plan used by the current project. The research questions and associated hypotheses were presented, and the method of how data were used to investigate each hypothesis was outlined. Articulation of independent and dependent variables, and the relationships among variables, were discussed, as was the plan to analyze all data via SPSS version 22. Finally, measures to protect the ethical rights of research subjects were delineated.

Chapter 4: Results

Introduction

The purpose of this quantitative correlational study was to examine whether openness to innovation, perceived ease of use of a technology, and perceived usefulness of a technology leads to the effective implementation of ERP software systems in SMB environments, controlling for the variables of the number of employees at a company, whether the company engages in internet commerce, and the age, gender, and educational attainment of the respondent. The data analyses and statistical results I used to investigate the primary research questions are presented in this chapter. I present data preparation steps below, followed by a discussion the variables and methods I used to investigate the specific tenets of each research question. I then present descriptive statistics and an overview of Cronbach alpha reliability estimations, and conclude by presenting regression in the context of the four research questions.

Data Preparation

In order to ensure that at least 150 senior executives of SMBs participated in the online survey, I sent survey invitations via email to the 3,000 individuals who were randomly selected into the sample. I used a three-push email contact method to maximize the response rate of the survey. The three-push email contact method is also known as the Dillman Tailored Design Method (Dillman et al., 2014). Using this method, I sent an initial invitation email to all potential respondents in a sample. The invitation email contained information about the nature of the survey and a link to the online survey. After one week elapsed, I again contacted all potential respondents who did not respond to the

first email survey via a second invitation email. The second invitation email again contained information on the nature of the survey and a link to the online survey. The second email also contained additional information regarding how important it is for the respondent to participate in the survey. After an additional week had elapsed, I sent a final invitation email to all potential respondents who did not respond to the first or second survey. As before, the third email contained information about the survey and a link to the survey. The third email also contained notification that the final email was the last opportunity for the respondent to participate in the survey. I suspended all data collection one week after sending the final email.

Prior to all statistical analyses, I determined that the analyses should only be conducted on individuals who provided complete responses to all questions in the survey. Thus, I included in the final dataset only individuals who had valid data points for all of the questions asked.

There were a total of 198 individuals who initiated participation in the survey. Of these individuals, three indicated that they did not wish to proceed with the survey when presented with the consent form. Another 41 respondents terminated their participation prior to the completion of the survey. Thus the final sample I used for purposes of all data analyses was 154 completed surveys. The difference between the total number of individuals who initiated the survey and the total number of completed surveys was 44. This difference represents a 22.2% attrition between the total number of individuals who initiated participation within the survey and those individuals who completed all survey questions.

I constructed three scales for use in this investigation: the *perceived ease of use (PEU) scale,* the *perceived usefulness (PU) scale*, and the *individual innovativeness (II) scale.* I constructed these scales by adding together all scale items and then dividing by the total number of scale items present. For example, the PEU scale is comprised of six questions. I added these six questions were added together, and then divided the resultant sum by the total number of questions present (i.e., divided by 6). Using this strategy allowed me to carry the measurement metric of the PEU scale questions through to the final calculated scale. Thus, the PEU scale is measured on a five-point metric, where a score of 1 equals "Strongly Disagree" and a score of 5 equals "Strongly Agree." Higher scores for this scale indicate higher levels of importance. The same logic articulated for the PEU scale also applies to the PU and II scales, as they are both measured on the same five-point metric where a score of 1 equals "Strongly Disagree" and a score of 5 equals "Strongly Agree."

I created the dependent variable in this investigation (whether the respondent used the correct decision to adopt the innovation) as a combination of the scenario a respondent was assigned and the answer the respondent provided to Question 4 of the survey which asked, "In your professional opinion, should Rockhampton Drapers proceed with the purchase of the new software" (see Appendix B). The correct answer for scenarios 1 and 4 was to not adopt the innovation, whereas the correct answer for scenarios 2 and 3 was to adopt the innovation. If the respondent made the correct decision with his or her randomly assigned scenario, I coded the dependent variable as "1 - Correct decision was made." If the respondent made an incorrect decision with his or her

randomly assigned scenario, I coded the dependent variable as "0 - Incorrect decision was made."

Research Questions and Variables Used

In this study, I sought to determine whether openness to innovation, as measured by the individual innovativeness scale, leads to the effective implementation of ERP software systems in SMB environments (i.e., the correct decision to adopt a software innovation), controlling for the variables perceived ease of use, perceived usefulness, the number of employees at a company, whether the company engages in internet commerce, and the age, gender, and educational attainment of the respondent. In order to effectively examine these ideas, the following research questions and hypotheses were constructed.

*RQ*1: To what extent does a senior manger's technology acceptance, as defined by perceived ease of use, influence the decision to implement ERP software innovations in small to medium business settings?

In order to empirically investigate RQ1, I developed the following hypotheses:

$H1_0$: Perceived ease of use of ERP software does not increase the decision to adopt ERP software.

$H1_a$: Perceived ease of use of ERP software does increase the decision to adopt ERP software.

For the first research question, I measured the dependent variable of whether or not a respondent made the correct decision to adopt an ERP software innovation as a dichotomous nominal-level indicator that identified whether a responded made the correct decision as a function of the scenario to which they were assigned. For this

variable, I coded making the correct decision as "1" and making the incorrect decision as "0."

For RQ1, I used multiple independent variables (e.g., perceived ease of use, the number of employees at a company, whether the company engages in internet commerce, and the age, gender, and educational attainment of the respondent) to predict whether or not a respondent made the correct decision to adopt the ERP software innovation. Because the dependent variable for RQ1 was a dichotomous binary indicator, and because RQ1 used multiple independent variables, a binary logistic regression technique was the optimal approach for investigating the above research question. As Agresti and Franklin (2012) have proposed, binary logistic regression is the correct method to use when one has a single dependent variable and multiple independent variables. Agresti and Franklin (2012) further noted that binary logistic regression requires a dependent variable that is measured at a nominal level and has been reduced to a 0/1 coding scheme, two conditions that are satisfied in the current analysis scenario. As such, I used binary logistic regression as the analysis technique to investigate RQ1.

*R*Q2: To what extent does a senior manger's technology acceptance as defined by perceived usefulness influence his or her decision to implement ERP software innovations in small to medium business settings?

In order to empirically investigate RQ2, I developed the following hypotheses:

$H2_0$: As perceived usefulness of ERP software increases, the decision to adopt ERP software will either decrease or remain unchanged.

$H2_a$: As perceived usefulness of ERP software increases, the decision to adopt Enterprise Resource Planning software will also increase.

For the second research question, the dependent variable of whether or not a respondent made the correct decision to adopt an ERP software innovation was measured as a dichotomous nominal-level indicator that identified whether a responded made the correct decision as a function of the scenario to which they were assigned. For this variable, I coded making the correct decision as "1" and making the incorrect decision as "0."

For RQ2 I used multiple independent variables (e.g., perceived usefulness, the number of employees at a company, whether the company engages in internet commerce, and the age, gender, and educational attainment of the respondent) to predict whether or not a respondent made the correct decision to adopt the ERP software innovation. Because the dependent variable for RQ2 was a dichotomous binary indicator, and because RQ2 used multiple independent variables, a binary logistic regression technique was again the optimal approach for investigating the above research question. As Agresti and Franklin (2012) have proposed, binary logistic regression is the correct method to use when one has a single dependent variable and multiple independent variables. Agresti and Franklin further noted that binary logistic regression requires a dependent variable that is measured at a nominal level and has been reduced to a 0/1 coding scheme, two conditions that are satisfied in the current analysis scenario. As such, I used binary logistic regression as the analysis technique to investigate RQ2.

*RQ*3: To what extent does a senior manger's openness to innovation influence his

or her decision to implement ERP software innovations in small to medium business settings?

In order to empirically investigate RQ3, I developed the following hypotheses:

$H3_0$: As openness to innovation increases, the decision to adopt ERP software will either decrease or remain unchanged.

$H3_a$: As openness to innovation increases, the decision to adopt ERP software will also increase.

For the third research question, I measured the dependent variable of whether or not a respondent made the correct decision to adopt an ERP software innovation as a dichotomous nominal-level indicator that identified whether a responded made the correct decision as a function of the scenario to which they were assigned. For this variable, I coded making the correct decision as "1" and making the incorrect decision as "0."

For RQ3 I used multiple independent variables (e.g., openness to innovation, the number of employees at a company, whether the company engages in internet commerce, and the age, gender, and educational attainment of the respondent) to predict whether or not a respondent made the correct decision to adopt the ERP software innovation. Because the dependent variable for RQ3 was a dichotomous binary indicator, and because RQ3 used multiple independent variables, a binary logistic regression technique was the optimal approach for investigating the above research question. As Agresti and Franklin (2012) have proposed, binary logistic regression is the correct method to use when one has a single dependent variable and multiple independent variables. Agresti

and Franklin further noted that binary logistic regression requires a dependent variable that is measured at a nominal level and has been reduced to a 0/1 coding scheme, two conditions that are satisfied in the current analysis scenario. As such, I used binary logistic regression as the analysis technique to investigate RQ3.

*RQ*4: To what extent does a senior manager's openness to innovation channel the relationship between technology acceptance (as defined by perceived ease of use and perceived usefulness) and the decision to implement Enterprise Resource Planning software innovations in small to medium business settings?

In order to empirically investigate RQ4, I developed the following hypotheses:

$H4_0$: The effect of perceived ease of use and perceived usefulness on the decision to adopt Enterprise Resource Planning software is not mediated by openness to innovation.

$H4_a$: The effect of perceived ease of use and perceived usefulness on the decision to adopt Enterprise Resource Planning software is mediated by openness to innovation.

For the fourth research question, there were two dependent variables: openness to innovation and the decision to adopt ERP software. The first dependent variable functioned as a mediator through which the effects of perceived ease of use and perceived usefulness were channeled. The second dependent variable served as the penultimate dependent variable within the statistical model; that is, the decision concerning whether or not to adopt the ERP software innovation.

In the case where openness to innovation was the dependent variable, a multiple linear regression was required. This is because openness to innovation is operationalized

via the Individual Innovativeness (II) scale. The II scale is measured on a five-point continuous Likert scale that ranges from a low value of "Strongly Disagree" (coded as 1) to a high value of "Strongly Agree" (coded as 5). In addition, in RQ4 I used multiple independent variables (e.g., perceived ease of use, perceived usefulness, the number of employees at a company, whether the company engages in internet commerce, and the age, gender, and educational attainment of the respondent) to predict the value of openness to innovation as measured by the II scale. Given these facts, a multiple linear regression technique was the optimal approach for investigating the tenets of RQ4 where openness to innovation was the dependent variable. Agresti and Franklin (2012) proposed that multiple linear regression is the correct method to use when one has a single dependent variable and multiple independent variables. Agresti and Franklin further noted that multiple linear regression requires a dependent variable that is measured at either an interval or ratio level (i.e., a continuous level), a condition that is satisfied when using a Likert scale. As such, I used multiple linear regression as the analysis technique to investigate the aspects of RQ4 that involved openness to innovation as the dependent variable.

In the fourth research question I also used whether or not a respondent made the correct decision to adopt an ERP software innovation as a dependent variable. As previously noted, I measured this variable as a dichotomous nominal-level indicator that identified whether a responded made the correct decision as a function of the scenario to which they were assigned. For this variable, I coded making the correct decision as "1" and making the incorrect decision was coded as "0."

In RQ4 I used multiple independent variables (e.g., perceived ease of use, perceived usefulness, openness to innovation, the number of employees at a company, whether the company engages in internet commerce, and the age, gender, and educational attainment of the respondent) to predict whether or not a respondent made the correct decision to adopt the ERP software innovation. Because the dependent variable for the second part of RQ4 was a dichotomous binary indicator, and because RQ4 used multiple independent variables, a binary logistic regression technique was the optimal approach for investigating this question in which the decision to adopt an ERP software innovation served as the dependent variable. As Agresti and Franklin (2012) have proposed, binary logistic regression is the correct method to use when one has a single dependent variable and multiple independent variables. Agresti and Franklin further noted that binary logistic regression requires a dependent variable that is measured at a nominal level and has been reduced to a 0/1 coding scheme, two conditions that are satisfied in the current analysis scenario. As such, I used binary logistic regression as the analysis technique to investigate RQ4 with respect to use of the decision to adopt the ERP software innovation as the dependent variable.

Descriptive Statistics

Table 1 presents the percentages and frequencies for all categorical variables used in the current investigation. As Table 1 shows, two out of every three respondents (68.8%) were male. Only four in every ten respondents (42.9%) indicated that their company engages in Internet- based commerce. Nearly three out of every four respondents (73.4%) have at least a bachelor's degree, with one in five (20.1%) having a

master's degree and one in every fifteen respondents having either a doctoral degree (1.3%) or a professional degree (5.2%). With respect to the dependent variable, roughly seven out of every ten respondents (69.5%) made the correct decision to adopt the ERP software innovation.

Table 1

Percentages and Frequencies, Study Variables

	Frequency	Percent
Biological sex of respondent		
Male	106	68.8%
Female	48	31.2%
Company engages in Internet-based commerce		
Yes	66	42.9%
No	88	57.1%
Education level of respondent in years		
At least a high school diploma	9	5.8%
Some college, but no degree	32	20.8%
Bachelor's degree	72	46.8%
Master's degree	31	20.1%
Doctoral degree	2	1.3%
Professional degree	8	5.2%
Dependent variable: Did respondent make correct decision?		
No	47	30.5%
Yes	107	69.5%
N	154	100.0%

Table 2 presents the means and standard deviations for all continuous variables used in the current investigation. As Table 2 reveals, the average age of respondents was just slightly more than 52 years old, with a range of 28 years old to 73 years old. The average number of employees at a respondent's company is 634, with a range of 1 employee to 60,000 employees.

Table 2

Means and Standard Deviations, Study Variables

Variable	N	M	SD	Min	Max
Perceived ease of use scale	154	3.02	0.67	1	5
Perceived usefulness scale	154	3.81	0.80	1	5
Individual Innovativeness scale	154	3.29	0.41	1	5
Number of employees at company	154	634.19	4930.49	1	60000
Age of respondent	154	52.10	9.47	28	73

For the PEU, PU and II scales, the respective means are interpreted as a function of their measurement metric. For all three scales, the midpoint of the scale is 3.0. Mean scores above the midpoint indicate higher levels of agreement for a given scale; scores below the midpoint indicate lower levels of agreement with a given scale. The midpoints of all three scales in Table 2 are over the midpoint, although in the case of the PEU scale this is only barely the case. Among the three scales, it is the PU scale that emerges as having the highest mean (M = 3.81). This suggests that among respondents, there is a higher level of perceived usefulness than there is openness to innovation (as measured by the II scale (M = 3.29)) and perceived ease of use (M = 3.02).

Table 3

Bivariate Correlations Among All Variables

Variables	1	2	3	4	5	6	7	8	9
1	1.00								
2	-0.10	1.00							
3	-0.10	0.28 **	1.00						
4	-0.02	0.03	0.15	1.00					
5	0.06	0.00	0.13	0.05	1.00				
6	0.03	0.07	0.14	0.04	0.12	1.00			
7	-0.05	0.16 *	0.07	-0.13	-0.16 *	-0.07	1.00		
8	0.16	-0.08	-0.10	-0.20 *	-0.12	-0.12	0.23 **	1.00	
9	0.00	-0.07	0.16 *	0.05	0.01	0.01	0.02	0.07	1.00

Note: * < p .05; ** < p .01; *** < p .001, two-tailed tests.

Key for variables in Table 3:

1. Dependent variable: Decision to innovate
2. Perceived ease of use scale
3. Perceived usefulness scale
4. Individual innovativeness scale
5. Number of employees at company
6. Company engages in Internet-based commerce
7. Biological sex of respondent
8. Age of respondent
9. Education level of respondent in years

The bivariate analyses also reveal that perceived ease of use of an innovation is positively and significantly correlated with the perceived usefulness of an innovation (r = 0.28, $p < .01$), and that men are more likely to perceive the ease of use of an innovation than women in the sample (r = 0.16, $p < .01$). The perceived usefulness of an innovation was positively correlated with the educational level of respondents (r = 0.16, $p < .05$). A negative correlation exists openness to innovation and the age of a respondent, (r = -0.20, $p < .05$), which suggests that as age increases, openness to innovation decreases.

Cronbach Alpha

Table 4 presents the Cronbach Alpha reliability coefficients for each of the three scales that were used in the current investigation. As Tavakol and Dennick (2011) have noted, the alpha statistic was developed by Lee Cronbach to provide a measure of the internal consistency of a scale as a function of its reliability. The measure of alpha ranges between a value of 0 and 1, with higher scores generally indicating better reliability. Scores of .70 or higher suggest that a scale has an acceptable level of reliability (Tavakol & Dennick, 2011). Both the PEU and PU scales presented above exceed the .70 benchmark, a result that would suggest an acceptable level of reliability for these two scales. Indeed, the alpha scores for these two scales suggest outstanding reliability for both scales.

Table 4

Internal Consistency Values (Cronbach α)

Scale	α
Perceived ease of use scale	0.909
Perceived usefulness scale	0.944
Individual Innovativeness scale	0.734

It should be noted that the original alpha score of the II scale was below the acceptable benchmark of .70. In a situation where a scale has an unacceptable level of reliability, it is recommend that individual scale questions be removed one at a time until there is a sufficient rise in alpha reliability to clear the .70 benchmark (Tavakol & Dennick, 2011). To this end, I removed Question 9 from the II scale. The removal of Question 9 from the scale resulted in an increase in Cronbach alpha reliability from .650 to .734.

Regression Results

Tables 5 and 6 present the results of the binary logistic regression and multiple linear regression equations that were used to investigate the tenets of the four research questions. The results of each of the four research hypothesis tests are presented below.

$H1_0$: Perceived ease of use of ERP software does not increase the decision to adopt ERP software.

$H1_a$: Perceived ease of use of ERP software does increase the decision to adopt ERP software.

$H2_0$: As perceived usefulness of ERP software increases, the decision to adopt ERP software will either decrease or remain unchanged.

$H2_a$: As perceived usefulness of ERP software increases, the decision to adopt Enterprise Resource Planning software will also increase.

Model 1 of Table 5 presents the binary logistic regression of decision to innovate onto the various independent predictors. In this aspect of the analysis I focused on the direct impact that perceived ease of use and perceived usefulness have on the decision to

innovate, controlling for the factors of the number of employees at a company, whether the company engages in internet commerce, and the age, gender, and educational attainment of the respondent. I also utilized Model 1 to investigate the tenets of Hypothesis 1 and Hypothesis 2.

The first parameter of interest in Model 1 of Table 5 is the chi-square goodness of fit indicator. As Agresti and Franklin (2012) noted, this statistic is an omnibus check of the overall predictive validity of the entire model. The omnibus chi-square goodness of fit indicator is statistically nonsignificant ($X^2 = 8.113$; $df = 7$; $p > .05$), which suggests that none of the predictors in the Model 1 equation have a statistically significant impact upon the dependent variable in the model. As Agresti and Franklin (2012) proposed, when the omnibus chi-square goodness of fit indicator is nonsignificant, further decomposition of effects in a binary logistic regression equation is rendered moot. There is thus no evidence to suggest that perceived ease of use of ERP software and perceived usefulness of ERP software will increase the decision to adopt ERP software, controlling for the factors of the number of employees at a company, whether the company engages in internet commerce, and the age, gender, and educational attainment of the respondent. On the basis of the evidence, it can be concluded that there is no support from the data for RQ1 or RQ2.

$H3_0$: As openness to innovation increases, the decision to adopt ERP software will either decrease or remain unchanged.

$H3_a$: As openness to innovation increases, the decision to adopt ERP software will also increase.

Model 2 of Table 5 presents the binary logistic regression of decision to innovate onto the various independent predictors. In Model 2 I focused on the direct impact that openness to innovation has on the decision to innovate, controlling for the factors of the number of employees at a company, whether the company engages in internet commerce, and the age, gender, and educational attainment of the respondent. I utilized Model 2 to investigate the tenets of H3.

The first parameter of interest in Model 2 of Table 5 is the chi-square goodness of fit indicator. As Agresti and Franklin (2012) noted, this statistic is an omnibus check of the overall predictive validity of the entire model. The omnibus chi-square goodness of fit indicator is statistically nonsignificant ($X^2 = 6.414$; $df = 6$; $p > .05$), which suggests that none of the predictors in the Model 2 equation have a statistically significant impact upon the dependent variable in the model. As Agresti and Franklin (2012) noted, when the omnibus chi-square goodness of fit indicator is nonsignificant, further decomposition of effects in a binary logistic regression equation is rendered moot. There thus is no evidence to suggest that openness to innovation will increase the decision to adopt ERP software, controlling for the factors of the number of employees at a company, whether the company engages in Internet commerce, and the age, gender, and educational attainment of the respondent. On the basis of the evidence, it can be concluded that there is no support from the data for RQ3.

Table 5

Binary Logistic Regression of Decision to Innovate on the Independent Predictors

	Model 1			Model 2			Model 3		
Variable	*ß*	*exp(ß)*	*p*	*ß*	*exp(ß)*	*p*	*ß*	*exp(ß)*	*p*
Constant	0.441	1.554	0.780	-1.054	0.349	0.589	0.245	1.277	0.912
Perceived ease of use scale	-0.185	0.831	0.510				-0.184	0.832	0.511
Perceived usefulness scale	-0.229	0.796	0.367				-0.232	0.793	0.363
Individual Innovativeness scale				0.000	1.000	1.000	0.057	1.059	0.900
Number of employees at company	0.000	1.000	0.530	0.000	1.000	0.529	0.000	1.000	0.532
Company engages in Internet-based commerce	0.083	1.087	0.824	0.012	1.012	0.973	0.082	1.085	0.827
Biological sex of respondent	-0.253	0.777	0.548	-0.351	0.704	0.393	-0.249	0.780	0.556
Age of respondent	0.039	1.039	0.051	0.043	1.044	0.031	0.039	1.040	0.051
Education level of respondent in years	-0.025	0.975	0.884	-0.042	0.959	0.798	-0.025	0.975	0.882
N	154			154			154		
Chi-square goodness of fit	8.113		0.323	6.414		0.378	8.128		0.421
df	7			6			8		
Nagelkerke R^2	.072			.058			.073		

$H4_0$: The effect of perceived ease of use and perceived usefulness on the decision to adopt Enterprise Resource Planning software is not mediated by openness to innovation.

$H4_a$: The effect of perceived ease of use and perceived usefulness on the decision to adopt Enterprise Resource Planning software is mediated by openness to innovation.

Model 3 of Table 5 presents the binary logistic regression of decision to innovate onto the various independent predictors. In Model 3 I focused on the direct impact that openness to innovation has on the decision to innovate, controlling for the factors of perceived ease of use, perceived usefulness, the number of employees at a company, whether the company engages in Internet commerce, and the age, gender, and educational attainment of the respondent. I utilized Model 3 to investigate the tenets of H4.

The first parameter of interest in Model 3 of Table 5 is the chi-square goodness of fit indicator. As Agresti and Franklin (2012) noted, this statistic is an omnibus check of the overall predictive validity of the entire model. The omnibus chi-square goodness of fit indicator is statistically nonsignificant ($X^2 = 8.128$; $df = 8$; $p > .05$), which suggests that none of the predictors in Model 3 equation have a statistically significant impact upon the dependent variable in the model. As Agresti and Franklin (2012) proposed, when the omnibus chi-square goodness of fit indicator is nonsignificant, further decomposition of effects in a binary logistic regression equation is rendered moot. There is thus no evidence to suggest that perceived ease of use, perceived usefulness, and openness to innovation will increase the decision to adopt ERP software, controlling for the factors of

the number of employees at a company, whether the company engages in internet commerce, and the age, gender, and educational attainment of the respondent.

Table 6

Multiple Linear Regression for Indirect Effects

Variable	*B*	*SE(B)*	*p*
Constant	3.428	0.291	0.000
Perceived ease of use scale	-0.004	0.052	0.942
Perceived usefulness scale	0.070	0.044	0.119
Number of employees at company	0.000	0.000	0.953
Company engages in Internet-based commerce	0.020	0.068	0.768
Biological sex of respondent	-0.089	0.075	0.238
Age of respondent	-0.007	0.004	0.049
Education level of respondent in years	0.013	0.031	0.668
N	154		
F	1.547		0.156
R^2	0.069		

I used the multiple regression model presented in Table 6 as a way to determine if perceived ease of use and perceived usefulness have a direct impact on openness to innovation, controlling for the factors of the number of employees at a company, whether the company engages in internet commerce, and the age, gender, and educational attainment of the respondent. The multiple linear regression equation is necessary in order to determine if openness to innovation mediates the effects that perceived ease of use and perceived usefulness have on the dependent variable of decision to adopt ERP software. The first parameter of interest in Table 6 is the *F* value. As Agresti and Franklin

(2012) noted, this statistic is an omnibus ANOVA F-test check of the overall predictive validity of the entire model. As can be seen in Table 6, the *F* value is statistically nonsignificant ($F = 1.547$; $df = 7, 146$; $p > .05$), which suggests that none of the predictors in the Table 6 equation have a statistically significant impact upon the dependent variable in the model. As Agresti and Franklin proposed, when the omnibus ANOVA F-test is nonsignificant, further decomposition of effects in a multiple linear regression equation are rendered moot. There is thus no evidence to suggest that the effect perceived ease of use perceived usefulness have on the decision to adopt ERP software is mediated by openness to innovation, controlling for the factors of the number of employees at a company, whether the company engages in internet commerce, and the age, gender, and educational attainment of the respondent.

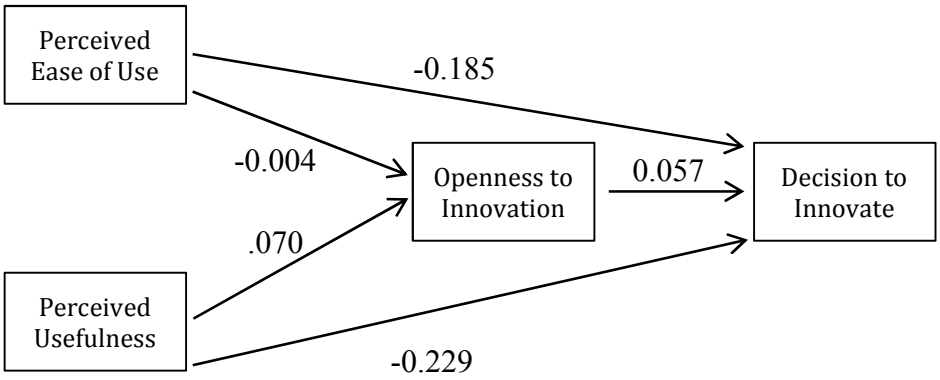

Figure 3. Statistical mediation effects, net of controls.

When the evidence in Model 3 of Table 4 is combined with the evidence in Table 5, it can be concluded that (a) there is no statistically significant direct effect of perceived ease of use and perceived usefulness on openness to innovation, and that (b) there is no statistically significant direct effect of openness to innovation on the decision to adopt

ERP software. By definition, the absence of direct effects in a mediation model means that there are no indirect effects (i.e., no mediation effect) present within the model (Hayes, 2013). Evidence of this is presented graphically in Figure 3. On the basis of the evidence, it can be concluded that there is no support from the data for RQ4.

Summary and Transition

This chapter presented an overview of the data preparation techniques used by the current investigation. It also included a discussion of the specific techniques used to analyze each research question. Descriptive statistics provided information on the basic patterns within the data for each variable, and Cronbach alpha estimates were used to demonstrate the reliability of the three scales used in the current investigation. I investigated all four research questions via binary logistic regression, and estimated mediation effects via multiple linear regression. I then related the findings of the data back to the hypotheses. In Chapter 5 I will present a discussion of the results, draw conclusions based on the results, and offer recommendations that future researchers may wish to consider.

Chapter 5: Discussion, Conclusions, and Recommendations

Introduction

The correct identification of the presence (or absence) of ERP software system problems is essential when making decisions that will lead to software adoption and innovation (Murray, 2012; Winsor, 2012). As I have noted throughout this dissertation, there is thus a need for senior managers of SMBs to correctly identify whether or not ERP software system problems exist. Instead of focusing on obtaining newly released software innovations, researchers have suggested that senior managers should instead seek to implement technological changes that enable the smooth and efficient operation of an SMB (Bernroidera et al., 2013; Maditinos et al., 2012; Ruivo et al., 2012; Xu et al., 2011).

One of the problems with any ERP software adoption is that management may believe that purchasing new technologies will solve most (if not all) ERP software system issues. Indeed, management sometimes obtains new software technologies for the sake of simply having them (Grabski et al., 2011; Weng & Hung, 2014). When senior managers of firms frame their businesses' software problems incorrectly in their search for new technological innovations, they may overlook the organizational aspects of change in ERP systems implementation, as well as possible negative consequences (such as the wasting of capital resources, the wasting of time, and the wasting of effort on improper software adoption) that may follow (Chiwamit et al., 2014; Hastie & Dawes, 2010).

In this project, I investigated if the degree to which a senior manager is open to a given systems management technological innovation impacts their decision concerning

the adoption of a technological innovation. I also investigated the problem of whether or not the perceived ease of use and perceived usefulness of the systems management innovation influenced a senior manager's decision to innovate. It has been suggested that openness to innovation, the perceived ease of a technology, and the perceived usefulness of a technology play a part in the decision to adopt a given technological innovation within a SMB environment (Davis, 1989; Avci-Yücel & Gülbahar, 2013; Marangunić & Granić, 2014).

I drew from these proposals to argue that a senior manager's perceptions concerning the ease of use and usefulness of ERP systems software may play a part in guiding his or her decision to adopt a new technological innovation. The purpose of this dissertation project was to investigate if senior managers in SMBs were able to correctly identify whether or not to adopt innovations relating to ERP systems software. Specifically, the purpose of this quantitative study was to examine the research question of whether openness to innovation, as measured by the individual innovativeness scale, leads to the effective implementation of ERP software systems in SMB environments, controlling for the variables perceived ease of use, perceived usefulness, the number of employees at a company, whether the company engages in internet commerce, and the age, gender, and educational attainment of the respondent.

To achieve this end, I sought to discover if there was a relationship between the decision to innovate and a technology's perceived ease of use, a technology's perceived usefulness, and a manager's openness to innovation among senior managers of SMBs. An investigation of this scope is important, especially when one considers that software

implementation decisions on the part of senior management can cause businesses to lose significant revenue (Venkatesh et al., 2012). As such, the identification of whether senior managers properly identify ERP software systems technology implementation decisions is of critical importance to the health and wellbeing of SMBs.

For this study I utilized an online survey to gather data from a random sample of 154 senior executives of SMBs in the United States. I used binary logistic regression to examine the relationship between the key independent variables of perceived ease of technology use, perceived usefulness of the technology, openness to innovation and the dependent variable of the decision to innovate, net of the statistical controls.

The results of this quantitative project indicated that perceived ease of use, perceived usefulness, and openness to innovation do not impact the decision to innovate. The positive social change outcomes of this study suggest that decision makers should become more aware of factors that promote constructive and effective identification of how to remediate problems in management accounting.

In Chapter 5 I present a summary of the statistical results and an interpretation of the statistical findings in relation to the four primary research questions. I also present and discuss possible explanations for the lack of any statistically significant results in this investigation. This discussion is followed by recommendations for future research and an overview of the implications for social change associated with the findings of the project. The chapter finishes with a summary and conclusion.

Interpretation of Findings

In order to ensure that at least 150 senior executives of SMBs participated in the online survey, I sent survey invitations via email to the 3,000 individuals who were randomly selected into the sample. I used a three-push email contact method, also known as the Dillman Tailored Design Method (Dillman et al., 2014), to maximize the response rate. A total of 154 participants out of the 198 who responded were included in the final data analyses because 41 did not complete the survey and three indicated that they did not wish to proceed with the survey when presented with the consent form.

Statistical analysis of the data revealed that the average respondent was a middle-aged male who had a college degree and worked at a company that had slightly more than 600 employees and which had no Internet commerce. Seven out of every 10 respondents made the correct decision concerning whether or not to adopt the ERP software innovation with respect to the vignette they were presented in the survey. I used binary logistic regression to investigate the tenets of Research Questions 1 through 3, and used multiple linear regression to investigate the tenets of Research Question 4. I conducted all statistical analyses using SPSS, flagging all statistically significant results at an alpha probability level of 0.05. I discuss the results below as a function of each research question.

Research Question 1

With the first research question (RQ1), I sought to investigate the extent to which a senior manger's technology acceptance as defined by perceived ease of use would influence the decision to implement ERP software innovations in SMB settings. In order

to empirically investigate the tenets of RQ1, I developed the following hypotheses:

$H1_0$: Perceived ease of use of ERP software does not increase the decision to adopt ERP software.

$H1_a$: Perceived ease of use of ERP software does increase the decision to adopt ERP software.

I investigated the tenets of RQ1 using a binary logistic regression equation. I used the multiple independent variables (e.g., perceived ease of use, the number of employees at a company, if the company engages in internet commerce, and the age, gender, and educational attainment of the respondent) to predict whether or not a respondent made the correct decision to adopt the ERP software innovation. Because the dependent variable for RQ1 was a dichotomous binary indicator, and because I used multiple independent variables for RQ1, a binary logistic regression technique was the optimal approach for investigating the above research question.

In Chapter 4, I presented the results of this equation in Model 1 of Table 4. My examination of the omnibus chi-square goodness of fit statistic associated with Model 1 of Table 4 showed that the overall model was statistically non-significant. This result means that none of the logit coefficients in Model 1 of Table 4 are statistically significant, which in turn suggests that there is no relationship between perceived ease of use of ERP software and the likelihood that a senior manager will adopt said innovation. There is thus no support for Hypothesis 1, and by extension, the tenets of RQ1.

Research Question 2

With the second research question (RQ2), I sought to investigate the extent to which a senior manager's technology acceptance as defined by perceived usefulness would influence the decision to implement ERP software innovations in SMB settings. In order to empirically investigate the tenets of RQ2, I developed the following hypotheses:

$H2_0$: As perceived usefulness of ERP software increases, the decision to adopt ERP software will either decrease or remain unchanged.

$H2_a$: As perceived usefulness of ERP software increases, the decision to adopt Enterprise Resource Planning software will also increase.

I investigated the tenets of RQ2 via a binary logistic regression equation. I used multiple independent variables for RQ2 (e.g., perceived usefulness, the number of employees at a company, if the company engages in internet commerce, and the age, gender, and educational attainment of the respondent) to predict whether or not a respondent made the correct decision to adopt the ERP software innovation. Because the dependent variable for RQ2 was a dichotomous binary indicator, and because RQ2 used multiple independent variables, a binary logistic regression technique was again the optimal approach for investigating the above research question.

The results of this equation were presented in Model 1 of Table 4 in Chapter 4 of this dissertation. An examination of the omnibus chi-square goodness of fit statistic associated with Model 1 of Table 4 showed that the overall model was statistically non-significant. This result means that none of the logit coefficients in Model 1 of Table 4 are statistically significant, which in turn suggests that there is no relationship between

perceived usefulness of ERP software and the likelihood that a senior manager will adopt said innovation. There is thus no support for Hypothesis 2, and by extension, the tenets of RQ2.

Research Question 3

With the third research question (RQ3) I sought to investigate to what extent a senior manger's openness to innovation would influence the decision to implement ERP software innovations in SMB settings. In order to empirically investigate the tenets of RQ3, I developed the following hypotheses:

$H3_0$: As openness to innovation increases, the decision to adopt ERP software will either decrease or remain unchanged.

$H3_a$: As openness to innovation increases, the decision to adopt ERP software will also increase.

I investigated the tenets of RQ3 via a binary logistic regression equation. I used multiple independent variables for RQ3 (e.g., openness to innovation, the number of employees at a company, if the company engages in internet commerce, and the age, gender, and educational attainment of the respondent) to predict whether or not a respondent made the correct decision to adopt the ERP software innovation. Because the dependent variable for RQ3 was a dichotomous binary indicator, and because multiple independent variables were used for RQ3, a binary logistic regression technique was the optimal approach for investigating the above research question.

The results of this equation were presented in Model 2 of Table 4 in Chapter 4 of this dissertation. An examination of the omnibus chi-square goodness of fit statistic

associated with Model 2 of Table 4 showed that the overall model was statistically non-significant. This result means that none of the logit coefficients in Model 2 of Table 4 are statistically significant, which in turn suggests that there is no relationship between openness to innovation and the likelihood that a senior manager will adopt said innovation. There is thus no support for Hypothesis 3, and by extension, the tenets of RQ3.

Research Question 4

With the fourth research question (RQ4) I sought to investigate to what extent a senior manager's openness to innovation will channel the relationship between technology acceptance (as defined by perceived ease of use and perceived usefulness) and the decision to implement ERP software innovations in SMB settings. In order to empirically investigate the tenets of RQ4, I developed the following hypotheses:

$H4_0$: The effect of perceived ease of use and perceived usefulness on the decision to adopt Enterprise Resource Planning software is not mediated by openness to innovation.

$H4_a$: The effect of perceived ease of use and perceived usefulness on the decision to adopt Enterprise Resource Planning software is mediated by openness to innovation.

I investigated the tenets of RQ4 via a binary logistic regression equation and a multiple linear regression equation. For RQ4, there were two dependent variables: openness to innovation and the decision to adopt ERP software. The first dependent variable functioned as a mediator through which the effects of perceived ease of use and perceived usefulness were channeled. The second dependent variable served as the

penultimate dependent variable within the statistical model; that is, the decision concerning whether or not to adopt the ERP software innovation.

In the case where openness to innovation was the dependent variable, a multiple linear regression was required. This was necessary because openness to innovation is operationalized via the Individual Innovativeness (II) scale. I measured the II scale on a five-point continuous Likert scale that ranges from a low value of "Strongly Disagree" (coded as 1) to a high value of "Strongly Agree" (coded as 5). In addition, I used multiple independent variables for RQ4 (e.g., perceived ease of use, perceived usefulness, the number of employees at a company, if the company engages in internet commerce, and the age, gender, and educational attainment of the respondent) to predict the value of openness to innovation as measured by the II scale. Given these facts, a multiple linear regression technique was the optimal approach for investigating the tenets of RQ4 where openness to innovation was the dependent variable.

The results of these equations were presented in Model 3 of Table 4 and the regression model presented in Table 5 in Chapter 4 of this dissertation. An examination of the omnibus chi-square goodness of fit statistic associated with Model 3 of Table 4 showed that the overall model was statistically non-significant. This result means that none of the logit coefficients in Model 3 of Table 4 are statistically significant, which in turn suggests that there is no relationship between perceived usefulness of ERP software, the perceived ease of use of ERP software, and the likelihood that a senior manager will adopt said innovation.

There is also no relationship between a manager's openness to innovation and that manager's likelihood to adopt said innovation. Further, Table 5 shows that there are no indirect effects of perceived ease of use and perceived usefulness that are channeled via openness to innovation, as the omnibus F-test for this model is also statistically non-significant. When taken together, the results in Model 3 of Table 4 and the results in Table 5 show that there is no support for Hypothesis 4, and by extension, the tenets of RQ4.

The bivariate analyses also reveal in Table 3 that men are more likely to perceive the ease of use of an innovation than women in the sample. From an emotional disposition perspective, females are more prone to show trustworthiness than male by displaying vulnerability (Davis, Matthews & Twamley. 1999; Pinquart & Sörensen 2006). These differences peak in early adulthood and then decline slowly but continue to exist throughout middle and late adulthood (e.g., Davis et al. 1999; Ge et al. 2001; 2003; Russac et al. 2007). Females can develop trust by forming smaller social networks; fewer daily interactions enable greater allocation of intimate, time-consuming investment behaviors in individual relationships (Geary & Flinn 2002; Vigil 2008). These emotional disposition factors may contribute to women being less likely to perceive the ease of use of an innovation than men in the sample.

Possible Explanations for Statistically Non-significant Results

There are three possible explanations that might account for the statistically non-significant results associated with this project. Succinctly stated, the results are either due

to (a) a statistical issue, (b) a methodological issue, or (c) a theoretical issue. Each of these potential explanations is discussed below.

Statistical Issue

One possible explanation for the results may be the inability of the statistical tests to detect statistically significant effects within the data. The results may thus have resulted as a function of what Neuman (2011) referred to as a Type II error. As Neuman explained, a Type II error occurs when a researcher claims that there is no relationship in the sample, even though the relationship may in fact exist in the larger population from which the sample was drawn. A Type II error occurs when a researcher fails to reject a null hypothesis that should be rejected and concludes that there is no evidence in support of the alternative hypothesis. This type of error thus error occurs when a researcher says there is no relationship among variables when in fact a relationship does exist among variables within the parent population from which the sample was drawn.

In order to avoid the possibility of committing a Type II error, researchers routinely conduct what is known as an *a priori* power estimation. This power estimation is typically calculated via the G*Power 3.1 software program developed by Faul et al. (2009), although other power programs are available for use by a researcher. As Faul et al. noted, a priori power estimation involves the calculation of a desired sample size as a function of a predetermined alpha probability level (typically an $\alpha = .05$), a desired statistical power (symbolized by β and nominally set at 0.95; see Cohen, 1988), and a desired population effect size.

A population effect size is essentially the quantified degree to which a null hypothesis is demonstrated to be false and evidence exists for the support of an alternative hypothesis in a population from which a sample is drawn (Kraemer & Blasey, 2015). As Rodriguez (2007) noted, Cohen's *d* is the typical measure of population effect size used in power estimation calculations. This statistic is expressed in terms of standard deviation units as part of the calculation used to estimate a sample size necessary to ensure that sufficient statistical power exists to reject a null hypothesis should support for an alternative hypothesis exist within the data. Effect sizes as represented via Cohen's *d* for a multiple linear regression equation typically run from an extremely small effect size value of 0.2 to an extremely large effect size value of 0.35 (Faul et al., 2009).

For the current project, the a priori G*Power analysis suggested that this sample size of 133 would be adequate to reject the null hypothesis and find support for the alternative hypothesis, provided that a relationship between variables actually existed within the parent population from which the sample was drawn. As part of the G*Power calculation, I used an alpha level of 0.05, a statistical power of 0.95, a conservative effect size of 0.10 and a two-tailed approach for a regression analysis with 15 predictors.

Although it is possible that a Type II error is the driving force behind the statistical outcomes associated with this project, the probability of this being the driving force is minimal. As previously noted, I conducted an a priori G*Power estimation in order to determine optimal sample size before the onset of the data collection activities. The G*Power estimation suggested an optimal sample size of 133; this benchmark was exceeded with the obtained sample of 154 valid responses.

Because the gathered sample size was larger than the estimated sample size projected as part of the a priori power calculation, the possibility of a Type II error was minimal at best (Kraemer & Blasey, 2015). It must therefore be concluded that other factors were responsible for the inability to detect statistically significant effects within the data. Thus, given that steps were taken to minimize the potential of a Type II error, other explanations for the statistical outcomes associated with this project must be considered.

Methodological Issue

Another potential explanation for the statistically non-significant results associated with this project may lie within the methodological design. In the current project, I used a quantitative correlational methodological approach (Neuman, 2011) to investigate the tenets of the four main research questions. I gathered the data used to investigate the four main research questions via an online electronic survey that was distributed to a simple random sample drawn from a sampling frame of 3,000 email addresses of senior management executives of SMBs in the United States.

Drawing a simple random sample ensured that every potential respondent within the sampling frame had an equal chance of being selected into the sample (Dixon et al., 2015). Also, given that a random sample of respondents was invited to take an online survey, it can be argued that the use of a quantitative correlational methodological approach was sound (Neuman, 2011).

I designed the original electronic survey instrument to ensure that the primary inclusion criteria for participation in the study would be restricted to respondents who

were senior management executive, such as CEOs, CFOs, COOs, in small to medium business (SMB) firms that utilize ERP systems software in the United States. Although this restriction for participation in the survey remained in place throughout the project, the questions in the survey that would have identified the exact title of the senior management executive who took the survey, and the exact company for which the respondent worked, were deleted from the survey.

The rationale behind the deletion of these questions was that this information could have potentially broken ethical guidelines regarding the need to maintain the anonymity of a survey participant. The name of company where an individual worked, when coupled with the individual's title, might have led to the identification of that person. Without being able to gather a respondent's title information and organization information, it was impossible to determine whether the nature of the company (i.e., for what type of organization a respondent worked) and the exact managerial position of the respondent (i.e., if they were a CEO, CFO, COO) would have an impact on the decision to adopt ERP software innovations.

The failure to control for these two variables may have potentially caused the non-significant statistical outcomes, as the regression models may not have fully accounted for all relevant covariates within the prediction model (Agresti & Franklin, 2012). It may thus be the case that the results were driven by spurious factors (Neuman, 2011) that were not accounted for in the predictive model. According to Woolridge (2013), spuriousness in a regression equation typically occurs when a regression equation contains an independent variable that seems to be statistically related to the dependent

variable, but is in actuality highly correlated with another unaccounted for independent variable. Thus, the supposed relationship between the dependent variable and the independent variable is actually an artifact of the unaccounted for independent variable, as this variable happens to affect both the dependent variable and the independent variable simultaneously.

Although Woolridge (2013) framed his discussion of spuriousness within the context of a supposedly statistically significant relationship between a dependent variable and an independent variable being driven by an unaccounted for third variable, the obverse also holds. The *lack* of a statistically significant relationship between a dependent variable and an independent variable may thus be driven by the impact of an unaccounted for factor within a regression equation. In the current investigation, the possible spuriousness in the regression equations may have taken the form of what is known as statistical confounding (MacKinnon, Krull, & Lockwood, 2000) within the regression equation.

As MacKinnon et al. (2000) noted, statistical confounding is a form of spuriousness in a regression equation where an unaccounted for independent variable may be related to an accounted for independent variable and a dependent variable simultaneously. The inability of the regression equation to control for the unaccounted independent variable that is spurious will result in a false obscuring of the true relationship between accounted independent variables and the dependent variable within a regression equation. MacKinnon et al. also noted that the inclusion of the spurious confounder within a regression equation will typically result in an undistorted estimate of

the relationship between the previously included independent variables and the dependent variable.

Within the current investigation, it is possible that the variables that would have accounted for the nature of the company (i.e., for what type of organization a respondent worked) and the exact managerial position of the respondent (i.e., if they were a CEO, CFO, COO) both acted as spurious confounds within the regression equation. It can be argued that these two variables would most likely have had an impact on the decision to adopt ERP software innovations. For example, researchers have found that the type of organization, as well as the size of an organization, will directly impact any decisions to adopt ERP software (Elbertsen, Benders, & Nijssen, 2006; Jeyaraj, Rottman, & Lacity, 2006). In addition, Thong and Yap (1995) found that managerial position also has an impact on technology adoption. The failure to account for these factors may thus have contributed to the statistically non-significant results found in the current investigation.

Theoretical Issue

The final explanation of the statistical results associated with this project may be the fact that the theoretical framework used to investigate the decision to innovate might not have been sufficient for the task at hand. Although the TAM as defined by Davis (1989), and further refined by later authors, has widespread utility and applicability within the field of technology adoption, it is nevertheless a model that is predicated on economic rationality (Venkatesh et al., 2012). The use of the TAM model advances the notion that the decision to adopt a given technology is predicated on usefulness and ease

of use, both of which rely on a rational cost-benefit analysis of the technology in question (Bromiley & Rau 2011; Powell et al., 2011; Takemura, 2014).

While rationality undoubtedly plays a part in the decision to adopt new technological innovations, there may also be an irrational aspect to the adoption of new technological innovations. According to Becker, Knudsen, and Swedberg (2012), modern economic theory assumes rational actors, yet it is often the case that irrational behaviors will sometimes drive economic decisions. Other authors have supported this line of thought, in that as they have found that decision-making in a business environment is sometimes irrationally based on either emotions, so-called "gut instincts," and/or existing affective relationships with technology providers (Shiller, 2015; Svecova, Fotr, & Renner, 2012).

The extant literature suggests that people who must make economically driven decisions may be resistant to change as a function of their emotional states (Carr, 2014; Kustubayeva, Matthews, & Panganiban, 2012). Lerner, Li, Valdesolo, and Kassam (2015) suggested that "emotions constitute potent, pervasive, predictable, sometimes harmful and sometimes beneficial drivers of decision making" within the business world (p. 799).

Whether the emotional state experienced is pleasurable or unpleasant can impact decision outcomes (Foo, 2009). Interestingly, the valence between these two states is often the domain in which most business decisions (such as the decision to adopt new technological advances) rests. For example, the CEO of a company may recognize that the adoption of a ERP software innovation will help the company in the long-term, thus

leading to a pleasurable emotive outcome that results as a function of increased profitability. The CEO of a company may also simultaneously experience unpleasant feelings regarding the prospect of having to part with operating capital in order to adopt the new innovation.

It may not be possible to entirely separate business decisions from emotional responses (Fields & Kuperberg, 2012). Even though there is a dominance of rational paradigms with respect to economic decisions, the role of emotions is nevertheless an integral aspect of the decision-making process (Fields & Kuperberg). Fields and Kuperberg further suggested that this is especially the case with respect to ERP software selection, as the process of selecting ERP software involves risk and uncertainty.

On the basis of this line of thought, it could be argued that the failure to theoretically and empirically account for both rational and irrational aspects of the decision to implement ERP software innovations in SMB settings may have led to an underspecified and ultimately statistically non-significant empirical model. The addition of other theoretical approaches might help to more clearly articulate a successful empirical model that can identify the underlying patterns associated with the decision to implement ERP software innovations in small to medium business settings. To that end, it might be fruitful to consider the role of what Meshulam, Winter, Ben-Shakhar, and Aharon (2012) called *rational emotions* in the decision to adopt ERP software innovations in the SMB environment.

According to Meshulam et al. (2012), “emotions may be directly controlled and utilized in a conscious, analytic fashion, enabling an individual to size up a situation,

determine that a certain ‘mental state’ is strategically advantageous and adjust accordingly” (p. 11). Meshulam et al.’s experimental work showed that individuals are often able to regulate their own emotional states dependent upon the situation as a way to make what they refer to as an “emotionally influenced decision” (p. 14). It may thus be the case that business leaders are able to regulate and call forth emotional states as part of their business decision process. The understanding that emotions can be actively regulated is widely understood (see Gross, 2015). However, the idea of consciously regulating emotions within a business context has yet to be explored.

Recommendations for Future Research

On the basis of the outcomes of this project, future researchers may wish to consider four potential recommendations for their research endeavors. First, it is recommended that a larger and more robust sample be obtained as a hedge to overcome the potential Type II error that may have been associated with this project. A doubling of the sample size used in this project should be sufficient to address any and all potential Type II errors that may have been associated with this project.

Second, future researchers may wish to gather more specific information on their survey subjects, especially as it pertains to title and the nature of their company. Although the identification of both a respondent’s title and information on the company for which they work might lead to a breach of confidentiality, the identification of either

one of these pieces of information may be sufficient to control for potentially spurious factors within a predictive model.

Third, future researchers may wish to consider the introduction of new survey instrumentation into the empirical model that was investigated within this study. The inclusion of a survey instrument that is designed to gather information on the emotive aspects of the decision-making process in the adoption of ERP software innovations might be of some utility in articulating the irrational aspects associated with ERP software adoption by senior managers of SMBs. One survey instrument that might be of use is the Profile of Mood States (POMS) scale developed by McNair, Lorr, and Droppleman (1981). The POMS scale was designed to measure the six affective states of tension, depression, anger, vigor, fatigue, and confusion.

Another possibility might be a measure of emotional intelligence, a concept that Barthwal and Som (2012) proposed is the most important element for employee effectiveness and organizational growth. One measure of emotional intelligence that has widespread utility is the Trait Meta-Mood Scale (TMMS) (Látalová & Pilárik, 2015). This scale evaluates a person's ability to perceive emotions in others, utilize emotions in the decision-making process, understand a wide range of different emotions, and manage their own emotive states (Látalová & Pilárik, 2015).

Finally, future researchers may wish to consider the inclusion of theoretical ideas that lend themselves towards the rationality of emotions (Meshulam et al., 2012). As Foo (2009) noted, even though emotions may have an impact upon entrepreneurial endeavors, there have been few investigations that explore this possibility. The assumption of a

separation of rational decisions from emotive states in the business world may be unwise and should be reconsidered by subsequent investigators.

Implications for Social Change

As previously noted in Chapter 1, I hoped that the results of this study would help senior managers correctly choose whether or not to adopt needed ERP software and hardware innovations so that their company can remain competitive in a globalized economy at a time of rapid technological and social change. The statistical results of the current investigation found that the perceived ease of use of a technology, the perceived usefulness of a technology, and a senior manger's openness to innovation do not play a part in the decision to adopt ERP software innovations among senior managers of SMBs.

The results thus suggest that the rational aspects of ERP software innovation adoption do not play a part in the decision to innovate among senior managers in SMBs. It may then be the case that more emotionally based motives, such as affective and cognitively based resistance to change, may instead be what determines the decision to adopt ERP software innovations among senior managers. Croasdell, Kuechler, and Wawdo (2013) proposed that resistance to change within an information technology context is the adverse reaction to the desired behavior and outcome.

Studies in the area of resistance to change show that resistance can have both affective and cognitive components. For example, Flamholtz and Randle (2011) suggested that individuals who are faced with a change might resist the change via cognitive mechanisms, such as a lack or commitment to the change and/or negative evaluations about the change, as well as via emotionally based mechanisms such as fear,

apprehension, anxiety, and anger. It could thus be argued that resistance to change, which is considered the opposite of openness to innovation, may be the catalyst that determines whether or not a person decides to adopt an innovation (Flamholtz & Randle, 2011).

Consultants who understand that resistance to change is emotively and cognitively based may be better able to sway the opinions of senior managers concerning whether or not to adopt necessary ERP software innovations. This can be accomplished when consultants recognize that appeals to the emotive aspects of decision-making can be just as effective as appeals to the rational aspects of decision-making concerning the adoption of necessary ERP software upgrades. Durkin, McKenna, and Cummins (2012) proposed that emotions can be used to influence business decisions.

Wan and Yang (2014) proposed the adoption of ERP software is an emotional process. However, I found no research that directly examines the role that emotion plays in the decision to adopt ERP software innovations in SMB environments. The lack of research in this area is curious, especially given the fact that ERP software selection is often associated with uncertainty and risk, which could lead to negative emotive outcomes on the part of software adopters such as anxiety, fear and apprehension (Astan, 2015).

Consultants who recognize that ERP software adoption decisions are complex may have a better chance at convincing managers to adopt required ERP software innovations. An appeal to both emotional concerns and rational needs may thus be a consultant's key advantage when seeking to convince a senior manager to adopt an ERP software innovation that may be beneficial not only to the manager, but also to the

company, the employees, and clients.

Summary and Conclusion

There is a need for senior managers of SMBs to correctly identify whether or not ERP software system problems exist. The correct identification of the presence (or absence) of ERP software system problems is essential when making decisions that will lead to software adoption and innovation. Instead of focusing on obtaining newer software innovations, researchers have suggested that senior managers should instead seek to implement technological changes that enable the smooth and efficient operation of an SMB. One of the problems with ERP software adoption is that management may believe that the purchasing of newer technologies will solve most (if not all) ERP software system issues.

Management sometimes obtains new software technologies for the sake of simply having newer technology. When senior managers of firms frame their businesses' software problems incorrectly in their search for new technological innovations, they in turn may overlook the organizational aspects of change in ERP systems implementation, and negative consequences, such as the wasting of capital resources, the wasting of time, and the wasting of effort on improper software adoption, may follow. In the current project I drew from these understandings to argue that a senior manager's perceptions concerning the ease of use and usefulness of ERP systems software may play a part in guiding his or her decision to adopt a new technological innovation.

I set about to determine whether there was a relationship between the decision to innovate, a technology's perceived ease of use, a technology's perceived usefulness and a

senior manager's openness to innovation among the entrepreneurial business leaders of small to medium size businesses (SMBs) in the United States. In order to investigate this issue, I used Roger's (2003) diffusion of innovations theory and Davis' (1989) TAM as theoretical mechanisms to investigate the factors that may increase the likelihood of a senior executive's decision to adopt new ERP systems software.

The results of this quantitative project suggest that perceived ease of use, perceived usefulness and openness to innovation do not impact the decision to innovate, net of the statistical controls. Thus, results associated with the empirical investigation suggested that neither openness to innovation nor the perceived use and usefulness of an ERP software innovation would guide the decision to innovate among senior managers of SMBs that use ERP software. There are three possible explanations that might account for the statistically non-significant results associated with this project. Succinctly stated, the results are either due to (a) a statistical issue, (b) a methodological issue, or (c) a theoretical issue.

One possible explanation for the results may be due to the inability of the statistical tests to detect statistically significant effects within the data. Because the gathered sample size was larger than the estimated sample size projected as part of the a priori power calculation, the possibility of a Type II error is minimal at best (Kraemer & Blasey, 2015). It must therefore be concluded that other factors are responsible for the inability to detect statistically significant effects within the data. Given that steps were taken to minimize the potential of a Type II error, other explanations for the statistical outcomes associated with this project must be considered.

Another potential explanation for the statistically non-significant results associated with this project may lie within the methodological design. Within the current investigation, it is possible that the variables that would have accounted for the nature of the company (i.e., what type of organization a respondent worked for) and the exact managerial position of the respondent (i.e., if they were a CEO, CFO, COO) acted as spurious confounds within the regression equation. It can be argued that these two variables would most likely have had an impact on the decision to adopt ERP software innovations. For example, it has been found in the literature that the type of organization, as well as the size of an organization, will directly impact any decisions to adopt ERP software (Elbertsen et al., 2006; Jeyaraj et al., 2006). In addition, Thong and Yap (1995) found that managerial position also has an impact on technology adoption. The failure to account for these factors may thus have contributed to the statistically non-significant results found in the current investigation.

The final explanation that may be driving the statistical results associated with this project may be the fact that the theoretical framework used to investigate the decision to innovate might not have been sufficient for the task at hand. Although the TAM, as defined by Davis (1989), has widespread utility and applicability within the field of technology adoption, it is nevertheless a model that is predicated on economic rationality. While rationality undoubtedly plays a part in the decision to adopt new technological innovations, there may also be an irrational aspect to the adoption of new technological innovations.

Work by other authors supports this line of thought, insofar as the researchers found that decision-making in the business environment is sometimes irrationally based on either emotions, so-called 'gut instincts', and/or existing affective relationships with technology providers (Shiller, 2015; Svecova et al., 2012). Whether the emotional state experienced is either pleasurable or unpleasant can impact decision outcomes (Foo, 2009). Interestingly, the valence between these two states is often the domain in which most business decisions (such as the decision to adopt new technological advances) rests.

Future researchers may wish to consider these issues when extending this investigation's line of inquiry. It is recommended that a larger and more robust sample be obtained as a hedge to overcome the potential Type II error that may have been associated with this project. Future researchers may also wish to gather more specific information on their survey subjects, especially as it pertains to title and the nature of their company. Although the identification of both a respondent's title and information on the company they work for might lead to a breach of confidentiality, the identification of either one of these pieces of information may be sufficient to control for potentially spurious factors within a predictive model.

Future researchers may also wish to consider the inclusion of new survey instrumentation into the empirical model that was investigated within this study. The inclusion of a survey instrument that is designed to gather information on the emotive aspects of the decision-making process in the adoption of ERP software innovations might be of some utility in articulating the irrational aspects associated with ERP software adoption by senior managers of SMBs. One possible survey instrument that

might be of use is the POMS scale, which was designed McNair, Lorr and Droppleman (1981) to measure the six affective states of tension, depression, anger, vigor, fatigue and confusion.

Another possibility for future research might be a measure of emotional intelligence, a concept which Barthwal and Som (2012) proposed is most important element for employee effectiveness and organizational growth. One measure of emotional intelligence that has widespread utility is the TMMS (Látalová & Pilárik, 2015). This scale evaluates a person's ability to perceive emotions in others, utilize emotions in the decision-making process, understand a wide range of different emotions, and manage their own emotive states (Látalová & Pilárik, 2015).

The positive social change outcomes of this study suggest that decision makers should become more aware of factors that promote constructive and effective identification of how to remediate problems in management accounting. I hoped that the results of this study would be able to help senior managers correctly choose whether or not to adopt needed ERP software and hardware innovations so that their company can remain competitive in a globalized economy at a time of rapid technological and social change. The statistical results of the current investigation found that the perceived ease of use of a technology, the perceived usefulness of a technology and a senior manger's openness to innovation do not play a part in the decision to adopt ERP software innovations among senior managers of SMBs.

Consultants who recognize that ERP software adoption decisions can and often do push senior managers "outside their comfort zone" may have a better chance at

convincing managers to adopt required ERP software innovations. An appeal to both emotional concerns and rational needs may thus be a consultant's key advantage when seeking to convince a senior manager to adopt an ERP software innovation that may be beneficial not only to the manager, but also to his or her company, his or her employees, and his or her clients.

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Appendix A. Survey Content

Dependent Variable

Decision to Innovate

Decision to innovate will be based on the answer to question #3 in the four scenarios posted below. Question #3 is a forced binary choice that will identify whether or not the respondent to the survey has made the correct decision concerning whether or not the technological innovation should be adopted. Questions #1 and #2 are being used as red herrings to distract from the information presented in Question #3.

Each scenario below was designed to be identical in terms of content. There are only five factors in each scenario that have been modified to provide variability within each vignette. These five factors are as follows:

1) The age of the current software (either two years old or thirty years old);
2) Customer satisfaction (customers are either happy or unhappy);
3) Projected increase in growth after technology adoption (either four percent or twenty-three percent is projected);
4) Projected reduction in inventory turns (either three percent or seventeen percent is projected);
5) Cost of upgrade as a percent of annual revenue (either two percent or fifteen percent).

It should be noted that scenario #1 and #2 are polar opposites; in other words, all five factors in scenario #1 are set so that the correct decision is to not purchase the new software, whereas the five factors in scenario #2 are set so that the correct decision is to purchase the software.

The five factors in scenarios #3 and #4 have been set so that the correct decision is harder to ascertain on the part of the respondent. In these scenarios, three of the five factors have been set in one direction, while the other two factors have been set in the opposite direction. For scenario #3, the correct decision is to upgrade as three of the five factors have been set in that direction. For scenario #4, the correct decision is to not upgrade, as three of the five factors have been set in that direction.

Scenario 1: CORRECT DECISION IS **TO NOT** PURCHASE THE SOFTWARE.

Rockhampton Drapers provides specialized fabric and other materials to the fashion industry internationally. Key management personnel need to be able to obtain real-time customized performance reports to support decisions about purchasing, production, and pricing. In order to fulfill this goal, Rockhampton Drapers is considering upgrading its Enterprise Resource Planning (ERP) software. ERP software is a business management software package that companies can use to more effectively manage their business. ERP software allows companies to collect, store, and manage data on supply chains, product planning, marketing, sales, manufacturing, inventory management and company financials.

The current ERP software system is two years old. The software works well for the company, and most of Rockhampton Drapers customers are happy with the way that the way the software interfaces with their systems.

The ERPSoft corporation has informed Rockhampton Drapers that their current ERP software package is inadequate for their needs. ERPSoft is recommending that Rockhampton Drapers upgrade their ERP software, primarily because ERPSoft predicts a four percent increase in growth after implementation, as well as a three percent reduction in inventory turns. The cost of the software upgrade is projected to be equal to fifteen percent of Rockhampton Drapers' annual revenue.

The capacity to analyze ERP data is a high priority for Rockhampton Drapers.
- Yes
- No

More market research is needed to guide the decision about purchasing the new software.
- Yes
- No

In your professional opinion, should Rockhampton Drapers proceed with the purchase of the new software?
- Yes
- No

REASONS WHY UPGRADE IS INCORRECT IN THIS SCENARIO:
1) Current software is only two years old
2) Customers are happy
3) Only four percent increase in growth projected
4) Only three percent reduction in inventory turns projected
5) Cost of upgrade is fifteen percent of annual revenue

Scenario 2: CORRECT DECISION IS **TO** PURCHASE THE SOFTWARE.

Rockhampton Drapers provides specialized fabric and other materials to the fashion industry internationally. Key management personnel need to be able to obtain real-time customized performance reports to support decisions about purchasing, production, and pricing. In order to fulfill this goal, Rockhampton Drapers is considering upgrading its Enterprise Resource Planning (ERP) software. ERP software is a business management software package that companies can use to more effectively manage their business. ERP software allows companies to collect, store, and manage data on supply chains, product planning, marketing, sales, manufacturing, inventory management and company financials.

The current ERP software system is thirty years old. The software works well for the company, but most of Rockhampton Drapers customers are unhappy with the way that the way the software interfaces with their systems.

The ERPSoft corporation has informed Rockhampton Drapers that their current ERP software package is inadequate for their needs. ERPSoft is recommending that Rockhampton Drapers upgrade their ERP software, primarily because ERPSoft predicts a twenty-three percent increase in growth after implementation, as well as a seventeen percent reduction in inventory turns. The cost of the software upgrade is projected to be equal to two percent of Rockhampton Drapers' annual revenue.

The capacity to analyze ERP data is a high priority for Rockhampton Drapers.
- Yes
- No

More market research is needed to guide the decision about purchasing the new software.
- Yes
- No

In your professional opinion, should Rockhampton Drapers proceed with the purchase of the new software?
- Yes
- No

REASONS WHY UPGRADE IS CORRECT IN THIS SCENARIO:
1) Current software is thirty years old
2) Customers are unhappy
3) Twenty-three percent increase in growth projected
4) Seventeen percent reduction in inventory turns projected
5) Cost of upgrade is only two percent of annual revenue

Scenario 3: CORRECT DECISION IS **TO** PURCHASE THE SOFTWARE.

Rockhampton Drapers provides specialized fabric and other materials to the fashion industry internationally. Key management personnel need to be able to obtain real-time customized performance reports to support decisions about purchasing, production, and pricing. In order to fulfill this goal, Rockhampton Drapers is considering upgrading its Enterprise Resource Planning (ERP) software. ERP software is a business management software package that companies can use to more effectively manage their business. ERP software allows companies to collect, store, and manage data on supply chains, product planning, marketing, sales, manufacturing, inventory management and company financials.

The current ERP software system is thirty years old. The software works well for the company, and most of Rockhampton Drapers customers are happy with the way that the way the software interfaces with their systems.

The ERPSoft corporation has informed Rockhampton Drapers that their current ERP software package is inadequate for their needs. ERPSoft is recommending that Rockhampton Drapers upgrade their ERP software, primarily because ERPSoft predicts a twenty-three percent increase in growth after implementation, as well as a three percent reduction in inventory turns. The cost of the software upgrade is projected to be equal to two percent of Rockhampton Drapers' annual revenue.

The capacity to analyze ERP data is a high priority for Rockhampton Drapers.
- Yes
- No

More market research is needed to guide the decision about purchasing the new software.
- Yes
- No

In your professional opinion, should Rockhampton Drapers proceed with the purchase of the new software?
- Yes
- No

REASONS WHY UPGRADE IS CORRECT IN THIS SCENARIO:
1) Current software is thirty years old (reason **to** upgrade)
2) Customers are happy (reason **not to** upgrade)
3) Twenty-three percent increase in growth projected (reason **to** upgrade)
4) Only three percent reduction in inventory turns projected (reason **not to** upgrade)
5) Cost of upgrade is only two percent of annual revenue (reason **to** upgrade)

Three reasons to upgrade, two reasons not to upgrade. **Balance is in favor is to upgrade.**

Scenario 4: CORRECT DECISION IS **NOT TO** PURCHASE THE SOFTWARE.

Rockhampton Drapers provides specialized fabric and other materials to the fashion industry internationally. Key management personnel need to be able to obtain real-time customized performance reports to support decisions about purchasing, production, and pricing. In order to fulfill this goal, Rockhampton Drapers is considering upgrading its Enterprise Resource Planning (ERP) software. ERP software is a business management software package that companies can use to more effectively manage their business. ERP software allows companies to collect, store, and manage data on supply chains, product planning, marketing, sales, manufacturing, inventory management and company financials.

The current ERP software system is two years old. The software works well for the company, but most of Rockhampton Drapers customers are unhappy with the way that the way the software interfaces with their systems.

The ERPSoft corporation has informed Rockhampton Drapers that their current ERP software package is inadequate for their needs. ERPSoft is recommending that Rockhampton Drapers upgrade their ERP software, primarily because ERPSoft predicts a four percent increase in growth after implementation, as well as a seventeen percent reduction in inventory turns. The cost of the software upgrade is projected to be equal to fifteen percent of Rockhampton Drapers' annual revenue.

The capacity to analyze ERP data is a high priority for Rockhampton Drapers.
- Yes
- No

More market research is needed to guide the decision about purchasing the new software.
- Yes
- No

In your professional opinion, should Rockhampton Drapers proceed with the purchase of the new software?
- Yes
- No

REASONS WHY UPGRADE IS NOT CORRECT IN THIS SCENARIO:
1) Current software is two years old (reason **not to** upgrade)
2) Customers are unhappy (reason **to** upgrade)
3) Only four percent increase in growth projected (reason **not to** upgrade)
4) Seventeen percent reduction in inventory turns projected (reason **to** upgrade)
5) Cost of upgrade is fifteen percent of annual revenue (reason **not to** upgrade)

Two reasons to upgrade, three reasons not to upgrade. **Balance is in favor is to not upgrade.**

Independent Variables

Openness to Innovation
The Individual Innovativeness (II) scale by Hurt, Joseph, and Cook (1977). Shortened version used here.

_____ 4. I am generally cautious about accepting new ideas.
_____ 7. I rarely trust new ideas until I can see whether the vast majority of people around me accept them.
_____10. I am aware that I am usually one of the last people in my group to accept
_____13. I am reluctant about adopting new ways of doing things until I see them working for people around me.
_____14. I find it stimulating to be original in my thinking and behavior.
_____15. I tend to feel that the old way of living and doing things is the best way.
_____16. I am challenged by ambiguities and unsolved problems.
_____17. I must see other people using new innovations before I will consider them.
_____19. I am challenged by unanswered questions.
_____20. I often find myself skeptical of new ideas.

Response scale:
Strongly Disagree = 1; Disagree = 2; Neutral = 3; Agree = 4; Strongly Disagree = 5.

Perceived Usefulness
The perceived usefulness scale by Davis (1989).

Using (TOPIC) in my job would enable me to accomplish tasks more quickly.
Using (TOPIC) would improve my job performance.
Using (TOPIC) in my job would increase my productivity.
Using (TOPIC) would enhance my effectiveness on the job.
Using (TOPIC) would make it easier to do my job.
I would find (TOPIC) useful in my job.

Response scale:
Strongly Disagree = 1; Disagree = 2; Neutral = 3; Agree = 4; Strongly Disagree = 5.

Perceived Ease of Use
The perceived ease of use scale by Davis (1989).

Learning to operate (TOPIC) would be easy for me.
I would find it easy to get (TOPIC) to do what I want it to do.
My interaction with (TOPIC) would be clear and understandable.
I would find (TOPIC) to be flexible to interact with.

It would be easy for me to become skillful at using (TOPIC).
I would find (TOPIC) easy to use.

Response scale:
Strongly Disagree = 1; Disagree = 2; Neutral = 3; Agree = 4; Strongly Disagree = 5.

NOTE: (TOPIC) can assume whatever value we wish. In the current project, it might be best to have (TOPIC) be Enterprise Resource Planning (ERP) software. Questions can also be altered so that the company (and not the individual) is the target of the question (Davis, 1989).

Statistical Controls

Approximately how many employees are at your company? Please write your answer in the box below _____

Does your company engage in any internet-based commerce?
- Yes
- No

What is your gender?
- Male
- Female

What is your age? Please write your answer in the box below _____

What is the highest level of education you have achieved?
- At least a high school diploma
- Some college, but no degree
- Bachelor's degree
- Master's degree
- Doctoral degree
- Professional degree (such as a medical degree or law degree)
- Other (please write your answer in the box below _____)

Appendix B. Final Survey

A 25.0% To start, I would like you to consider the following scenario below.

Rockhampton Drapers provides specialized fabric and other materials to the fashion industry internationally. Key management personnel need to be able to obtain real-time, customized performance reports to support decisions about purchasing, production, and pricing. In order to fulfill this goal, Rockhamptom Drapers is considering upgrading its Enterprise Resource Planning (ERP) software. ERP software is a business management software package that companies can use to more effectively manage their business. ERP software allows companies to collect, store, and manage data on supply chains, product planning, marketing, sales, manufacturing, inventory management and company financials.

The current ERP software system is two years old. The software works well for the company, and most of Rockhamptom Drapers customers are happy with the way that the way the software interfaces with their systems.

The ERPSoft corporation has informed Rockhamptom Drapers that their current ERP software package is inadequate for their needs. ERPSoft is recommending that Rockhamptom Drapers upgrade their ERP software, primarily because ERPSoft predicts a four percent increase in growth after implementation, as well as a three percent reduction in inventory turns. The cost of the software upgrade is projected to be equal to fifteen percent of Rockhamptom Drapers' annual revenue.

Please answer the following questions based on this information contained in the scenario above.

B 25.0% To start, I would like you to consider the following scenario below.

Rockhampton Drapers provides specialized fabric and other materials to the fashion industry internationally. Key management personnel need to be able to obtain real-time, customized performance reports to support decisions about purchasing, production, and pricing. In order to fulfill this goal, Rockhamptom Drapers is considering upgrading its Enterprise Resource Planning (ERP) software. ERP software is a business management software package that companies can use to more effectively manage their business. ERP software allows companies to collect, store, and manage data on supply chains, product planning, marketing, sales, manufacturing, inventory management and company financials.

The current ERP software system is thirty years old. The software works well for the company, but most of Rockhamptom Drapers customers are unhappy with the way that the way the software interfaces with their systems.

The ERPSoft corporation has informed Rockhamptom Drapers that their current ERP software package is inadequate for their needs. ERPSoft is recommending that Rockhamptom Drapers upgrade their ERP software, primarily because ERPSoft predicts a twenty-three percent increase in growth after implementation, as well as a seventeen percent reduction in inventory turns. The cost of the software upgrade is projected to be equal to two percent of Rockhamptom Drapers' annual revenue.

Please answer the following questions based on this information contained in the scenario above.

C 25.0% To start, I would like you to consider the following scenario below.

Rockhampton Drapers provides specialized fabric and other materials to the fashion industry internationally. Key management personnel need to be able to obtain real-time, customized performance reports to support decisions about purchasing, production, and pricing. In order to fulfill this goal, Rockhamptom Drapers is considering upgrading its Enterprise Resource Planning (ERP) software. ERP software is a business management software package that companies can use to more effectively manage their business. ERP software allows companies to collect, store, and manage data on supply chains, product planning, marketing, sales, manufacturing, inventory management and company financials.

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Please answer the following questions based on this information contained in the scenario above.

D 25.0% To start, I would like you to consider the following scenario below.

Rockhampton Drapers provides specialized fabric and other materials to the fashion industry internationally. Key management personnel need to be able to obtain real-time, customized performance reports to support decisions about purchasing, production, and pricing. In order to fulfill this goal, Rockhamptom Drapers is considering upgrading its Enterprise Resource Planning (ERP) software. ERP software is a business management software package that companies can use to more effectively manage their business. ERP software allows companies to collect, store, and manage data on supply chains, product planning, marketing, sales, manufacturing, inventory management and company financials.

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Please answer the following questions based on this information contained in the scenario above.

2. The capacity to analyze ERP data is a high priority for Rockhampton Drapers.

- Yes
- No

3. More market research is needed to guide the decision about purchasing the new software.

- Yes
- No

C 25.0% To start, I would like you to consider the following scenario below.

Rockhampton Drapers provides specialized fabric and other materials to the fashion industry internationally. Key management personnel need to be able to obtain real-time, customized performance reports to support decisions about purchasing, production, and pricing. In order to fulfill this goal, Rockhamptom Drapers is considering upgrading its Enterprise Resource Planning (ERP) software. ERP software is a business management software package that companies can use to more effectively manage their business. ERP software allows companies to collect, store, and manage data on supply chains, product planning, marketing, sales, manufacturing, inventory management and company financials.

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The ERPSoft corporation has informed Rockhamptom Drapers that their current ERP software package is inadequate for their needs. ERPSoft is recommending that Rockhamptom Drapers upgrade their ERP software, primarily because ERPSoft predicts a twenty-three percent increase in growth after implementation, as well as a three percent reduction in inventory turns. The cost of the software upgrade is projected to be equal to two percent of Rockhamptom Drapers' annual revenue.

Please answer the following questions based on this information contained in the scenario above.

D 25.0% To start, I would like you to consider the following scenario below.

Rockhampton Drapers provides specialized fabric and other materials to the fashion industry internationally. Key management personnel need to be able to obtain real-time, customized performance reports to support decisions about purchasing, production, and pricing. In order to fulfill this goal, Rockhamptom Drapers is considering upgrading its Enterprise Resource Planning (ERP) software. ERP software is a business management software package that companies can use to more effectively manage their business. ERP software allows companies to collect, store, and manage data on supply chains, product planning, marketing, sales, manufacturing, inventory management and company financials.

The current ERP software system is two years old. The software works well for the company, but most of Rockhamptom Drapers customers are unhappy with the way that the way the software interfaces with their systems.

The ERPSoft corporation has informed Rockhamptom Drapers that their current ERP software package is inadequate for their needs. ERPSoft is recommending that Rockhamptom Drapers upgrade their ERP software, primarily because ERPSoft predicts a four percent increase in growth after implementation, as well as a seventeen percent reduction in inventory turns. The cost of the software upgrade is projected to be equal to fifteen percent of Rockhamptom Drapers' annual revenue.

Please answer the following questions based on this information contained in the scenario above.

2. The capacity to analyze ERP data is a high priority for Rockhampton Drapers.

- Yes
- No

3. More market research is needed to guide the decision about purchasing the new software.

- Yes
- No

4. In your professional opinion, should Rockhampton Drapers proceed with the purchase of the new software?

- Yes
- No

For each of the statements below, please indicate whether you strongly agree, agree, disagree, or strongly disagree with the statement. Please answer each statement below honestly.

5. I am generally cautious about accepting new ideas.

- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

6. I rarely trust new ideas until I can see whether the vast majority of people around me accept them.

- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

7. I am aware that I am usually one of the last people in my group to accept something new.

- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

8. I am reluctant about adopting new ways of doing things until I see them working for people around me.

- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

9. I find it stimulating to be original in my thinking and behavior.

- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

10. I tend to feel that the old way of living and doing things is the best way.

- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

11. I am challenged by ambiguities and unsolved problems.

- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

12. I must see other people using new innovations before I will consider them.

- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

13. I am challenged by unanswered questions.

- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

14. I often find myself skeptical of new ideas.

- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

This next section of the survey will ask you some questions concerning Enterprise Research Planning (ERP) software. As noted previously, ERP software is a business management software package that companies can use to more effectively manage their business. ERP software allows companies to collect, store, and manage data on supply chains, product planning, marketing, sales, manufacturing, inventory management and company financials.

For each of the statements below concerning ERP software, please indicate whether you strongly agree, agree, disagree, or strongly disagree with the statement. Please answer each statement below honestly.

15. Having my company adopt ERP software would enable my company to accomplish tasks more quickly.

- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

16. Having my company use ERP software would improve company job performance.

- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

17. Having my company use ERP software would increase company productivity.

- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

18. Having my company use ERP software would enhance company effectiveness in the marketplace.

- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

19. Having my company use ERP software would make it easier for employees at my company do their job.

- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

20. I would find ERP software useful for my company.

- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

21. Learning to operate ERP software would be easy for the employees at my company.

- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

22. The employees at my company would find it easy to get ERP software to do what they want it to do.

- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

28. Does your company engage in any internet-based commerce?

- Yes
- No

29. What is your gender?

- Male
- Female

30. What is your age? Please write your answer in the blank.

31. What is the highest level of education you have achieved?

- At least a high school diploma
- Some college, but no degree
- Bachelor's degree
- Master's degree
- Doctoral degree
- Professional degree (such as a medical degree or law degree)

Other (please write your answer in the blank)

Thank you for taking the time to complete this survey!

23. Employee interaction with ERP software would be clear and understandable.

- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

24. Employees at my company would find ERP software to be flexible to interact with.

- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

25. Employees at my company would be easy to become skillful at using ERP software.

- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

26. Employees at my company would find ERP software easy to use.

- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

You're almost done with the survey. All that remains are a final few questions that will help me to better classify your responses.

Please remember to fill out each question below honestly, and please know that none of your answers will be linked back to you in any way.

27. Approximately how many employees are at your company? Please write your answer in the blank.

Appendix C. Survey Consent Form

My name is Michael Bertini, and I am inviting you to take part in a doctoral research project study that will examine the relationship between openness to innovation and decisions concerning innovation. The title of the project is *The Impact of Technology Acceptance and Openness to Innovation on Software Implementation*.

You are being invited to participate in this survey because you are a senior management executive of a small to medium business (SMB) firm that utilizes Enterprise Research Planning (ERP) software systems in the United States. Please know that before you can participate, you will need to take part in a process called "informed consent" that will allow you to make a voluntary and informed decision as to whether you would like to participate.

Please know that the purpose of this study is to identify conditions in which senior managers are likely to determine whether or not to adopt innovations relating to ERP systems. You will be asked to participate in an online survey, and the survey will take approximately 7 to 10 minutes of your time to complete.

Voluntary Nature of the Study:
This study is voluntary in nature. Everyone will respect your decision of whether or not you choose to be in the study. No one will treat you differently if you decide not to be in the study. If you decide to join the study now, you can still change your mind later. You may stop at any time.

Risks and Benefits of Being in the Study:
Participation in this study involves poses no appreciable risk to you, as you will be asked to do an activity that is often encountered in daily life (i.e., filling out an online survey). Please know that the anticipated benefits of this project for society is that we will have a better understanding of how technology acceptance and openness to innovation impacts the decision of senior managers to adopt software innovations.

Payment:
There will be no payment, thank you gifts, or reimbursements that will be provided to you for your participation.

Privacy:
All information that you will provide will be anonymous. The researcher will not use your personal information for any purposes outside of this research project. Also, the researcher will not link your name, email address, computer IP address or anything else that could identify you to the answers you provide in the survey. Data will be kept secure at all times behind a computer firewall and all data will be password encrypted. Data will be kept for a period of at least 5 years, as required by the university.

Contacts and Questions:
If you have any questions, you may contact the primary researcher, Michael Bertini, at MichaelB@osas.com, or via telephone at 1-612-805-2108. If you want to talk privately about your rights as a participant, you can also contact the chair of Walden University's IRB, Leilani Endicott, at irb@waldenu.edu. Walden University's approval number for this study is 05-14-15-0189242 and it expires on May 13, 2016.

Statement of Consent:
I have read the above information and I feel I understand the study well enough to make a decision about my involvement. By filling out the online survey, I understand that I am agreeing to the terms described above.

To protect your privacy, no consent signature is requested. Instead, your completion of the survey will indicate your consent, if you choose to volunteer. Please know that you may print a copy of this consent form or save a copy of this consent form at this time.

1. Do you wish to continue with the survey? Please know that clicking 'yes' indicates your consent to continue with the survey. Clicking 'no' will end your participation.

- ○ Yes
- ○ No