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An Examination of Small Businesses' Propensity to Adopt Cloud-Computing Innovation

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This is to certify that the doctoral study by

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has been found to be complete and satisfactory in all respects,
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2012

Abstract

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Doctoral Study Submitted in Partial Fulfillment

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Doctor of Business Administration

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Abstract

The problem researched was small business leaders' early and limited adoption of cloud computing. Business leaders that do not use cloud computing may forfeit the benefits of its lower capital costs and ubiquitous accessibility. Anchored in a diffusion of innovation theory, the purpose of this quantitative cross-sectional survey study was to examine if there is a relationship between small business leaders' view of cloud-computing attributes of compatibility, complexity, observability, relative advantage, results demonstrable, trialability, and voluntariness and intent to use cloud computing. The central research question involved understanding the extent to which each cloud-computing attribute relate to small business leaders' intent to use cloud computing. A sample of 3,897 small business leaders were selected from a commerce authority e-mail list yielding 151 completed surveys that were analyzed using regression. Significant correlations were found for the relationships between the independent variables of compatibility, complexity, observability, relative advantage, and results demonstrable and the dependent variable intent to use cloud computing. However, no significant correlation was found between the independent variable voluntariness and intent to use. The findings might provide new insights relating to cloud-computing deployment and commercialization strategies for small business leaders. Implications for positive social change include the need to prepare for new skills for workers affected by cloud computing adoption and cloud-computing ecosystem's reduced environmental consequences and policies.

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Dedication

I wish to thank Jesus Christ for the privilege of being able to pursue my dreams. I dedicate this work to give honor and glory to God in pursuit of those dreams.

Acknowledgments

I wish to express my great appreciation and heartfelt gratitude to my wife, Sandi, for her encouragement and assistance throughout my DBA study journey. With much gratitude, I thank Dr. Lawrence Ness, my DBA committee chairperson, for his insightful guidance, steadfast encouragement, and kindred spirit. I thank Dr. Russell Strickland, DBA committee member, for his consistently insightful critique and advice. I thank Dr. Gayle Grant for her perspectives as the URR for this study. Additionally, I am grateful to Mr. Brian Sherman and the Arizona Commerce Authority for cooperating in this study by inviting survey participants.

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Section 1: Foundation of the Study

Small business employment and production are essential for the economic health of the United States (Small Business Administration [SBA], 2009). Information technology (IT) innovation has been shown to foster sustainable business competitive advantage and economic viability (McAfee & Brynjolfsson, 2008; Oh & Pinsonneault, 2007; Porter & Millar, 1985). Cloud computing, the elastic and ubiquitous provisioning of IT services via the Internet, was envisioned as an emerging innovation enabling enterprise strategies via a novel business-computing paradigm to achieve competitive advantage (Cheng, 2010; Gens et al., 2010; Smith, 2009; Wyld, 2009).

In this doctoral study, small business leaders' perceptions of cloud-computing innovation and their propensity to adopt this emerging technology were examined. Background information is presented as a foundation for the economic importance and volatility of U.S. small businesses. IT innovation is discussed as a basis for contributing to competitive advantage. Cloud computing was described as an innovative business-computing paradigm delivering economic value via global IT scale and scope (Mell & Grance, 2010; Truong, 2010). Based on the predictive ability derived from the diffusion of innovations theory, specific research questions were addressed by testing hypotheses that examined the relationship of perceived innovation attributes and small businesses' propensity to adopt emerging cloud-computing technology. A review of the literature is presented to support the significance of this research, which was framed in addressing the gap in understanding related to small businesses' proclivity to use cloud-computing innovation as a means of obtaining economic value.

Background of the Problem

The subject area of interest for this doctoral research project was the propensity of small business leaders to adopt emerging cloud-computing innovation. The conceptualization of cloud-computing innovation was inspired in the genesis of the Internet (Buyya, Yeo, Venugopal, Broberg, & Brandic, 2009). Envisaged as utility-like, cloud computing was featured as the ubiquitous, on-demand, self-service, elastically scalable, pay-for-use provisioning of information technologies via the Internet (Cheng, 2010; Mell & Grance, 2010; Smith, 2009). Cloud-computing innovation was viewed as an emerging economy-of-scale leveraged commoditization of IT services including hardware, software, networking, or a combined platform of services together with its undergirding human capital IT acumen.

The long-term health and vitality of small businesses have been essential for economic prosperity and enjoyment of personal freedoms (Anderson, 2009; Michael & Pearce, 2009; Shackelford, 2009; SBA, 2009). The volatility and high rate of discontinuances of small businesses have become an economic threat for community and government interests (Bates, 2005; SBA, 2009). The lack of sustainability in small businesses threatens the viability of the United States' free market economic system.

Established to preserve free competitive enterprise, the SBA (2009) has recognized the critical importance of small businesses to U.S. economic strength as well as their role in the global marketplace. For the purposes of this doctoral study, the meaning of a small business was defined as a firm employing fewer than 500 employees and generating annual revenues of $50 million or less, which was consistent with the

SBA's definition. In the United States, small businesses have been reported as creating the greater part of the gross domestic product while comprising nearly all employers and employing the majority of the private sector workforce (Ibrahim, Angelidis, & Parsa, 2008; SBA, 2009).

An examination of the research revealed that innovation is essential for the economic benefits of sustainable business vitality (Braganza, Awazu, & Desouza, 2009; Elmore, 2007; Estrin, 2009; Mangelsdorf, 2009; Michael & Pearce, 2009). Innovation has been shown to yield competitive advantage via unique business process capabilities (Chalhoub, 2010; Hoerl & Gardner, 2010; Latzer, 2009), novel products and services for existing markets (Dew, Sarasvathy, Read, & Wiltbank, 2008), and disruptive creations of new markets (Carayannopoulos, 2009; Dewald, & Bowen, 2010; Hagel, Brown, & Davison, 2008). Specifically, investments in IT innovation and IT dependent strategies have been correlated with economic performance and competitive advantage (Latzer, 2009; McAfee & Brynjolfsson, 2008; Oh & Pinsonneault, 2007; Qureshil, Kamal, & Wolcott, 2009).

Unprecedented acceleration in competition triggered by Internet globalization amid the business volatility induced by recent economic turmoil has hastened the mandate for IT agility and efficiency at lower costs (Liao, Welsch, & Moutray, 2008; McAfee & Brynjolfsson, 2008; Renski, 2009). IT innovation has served as a catalyst for improving business performance and economic value (Dibrell, Davis, & Craig, 2008; Latzer, 2009; Porter & Millar, 1985). Anticipating delivery of economic value essential for business, cloud computing has been portrayed as a novel business computing paradigm extending IT flexibility and improving IT capabilities via ubiquitous provisioning of IT services (Katzan, 2008; Sultan, 2010). The pay-for-use aspect of the cloud-computing business paradigm was anticipated to mitigate capital-intensive IT costs, thereby benefiting capital-constrained small businesses (Marston, Li, Bandyopadhyay, Zhang, & Ghalsasi, 2010).

Diffusion of innovation (DOI) and technology acceptance model (TAM) theories have been used in research to understand the diffusion and acceptance of innovation among members of society (Davis, 1989; Rogers, 2003). Although the DOI research tradition has its genesis in diffusion of agricultural innovation inquiry dating back to the early 1960s (Rogers, 2003), there has been extensive DOI research related to diffusion of IT and Internet innovations (Andrés, Cuberes, Diouf, & Serebrisky, 2010; Rogers, 2003; Valier, McCarthy, & Aronson, 2008). Similarly, TAM has been used extensively as a theoretical framework for studying the acceptance of IT technologies based on ease of use and usefulness measures (Azadegan & Teich, 2010; Davis, 1989; Venkatesh, Morris, Davis, & Davis, 2003). Rooted in DOI and TAM theory, Valier et al. (2008) developed a predictive model for researching the adoption of IT innovation during its prediffusion stage. Valier et al.'s predictive DOI model undergirds the theoretical framework applied to this inquiry for examining the relationship between cloud-computing innovation and its adoption by small businesses.

The ability for small businesses to finance innovation has been a serious consideration in its use and economic viability (Robb & Robinson, 2009; Schwienbacher, 2007). Entrepreneurial financing often has been restricted to bootstrap financing techniques and limited debt financing whereas only a small fraction of small businesses were able to secure adequate equity financing (Barringer & Ireland, 2010; Paul, Whittam, & Wyper, 2007). Access to financial capital has been a factor influencing small businesses' investment in innovation and their strategies for growth. Technology innovations such as the Internet have mitigated capital barriers that previously restricted small business global competition, thus reducing the socioeconomic gaps often attributed to the diffusion of innovation and the spread of new ideas (Rogers, 2003).

Alleviating the capital investment requirements of large-scale IT capability, cloud-computing innovation has operationalized these front-loaded costs via pay-for-use global rapid provisioning of seemingly infinite on-demand IT services creating a novel business-computing model (Katzan, 2008, 2010; Marston et al., 2010; Mell & Grance, 2010). The emergence of disruptive business model innovations has contributed to the rapidly changing business environments (Dewald & Bowen, 2010). The cloud-computing business paradigm was perceived as a radical disruptive innovation supplanting extant business computing models' facilitation of competitive advantage. Early adoption of disruptive innovation often has garnered a leveraged marketplace opportunity to protect or unseat extant competitive advantage (Dew et al., 2008).

Large corporations and public sector organizations have been targeted as early adopters of emerging cloud-computing innovation purposing to yield greater competitive advantage and economic value (Braude, 2008; Davis, 2009; Gens et al., 2010; Mell & Grance, 2009; Smith, 2009; Wyld, 2009). The methods for past small business survival have undergone a transformation as small businesses have capitalized on emerging technology innovations (Carayannopoulos, 2009) to compete in an increasingly global economy. In a new era of competitive survival, early adoption of cloud-computing innovation was anticipated to provide the opportunity for small businesses to capitalize on this novel business-computing paradigm and to thrive in the changing global and virtual business environment. With the exception of limited utility functions such as hosted e-mail services (Schadler, 2009), a review of the research literature has revealed that small businesses have not been early adopters of emerging cloud-computing innovation (Truong, 2010; Wyld, 2009).

Scarcity of information related to the penchant of small businesses to adopt cloud-computing innovations was considered problematic because it is the sort of insight useful for establishing policies and other positioning influences to foster improved small business sustainability and economic vitality. Acquiring a better understanding of small business leaders' propensity to adopt cloud-computing innovations could help service providers improve positioning of this emerging technology for greater small business benefit and economic value. This scant understanding was addressed in this study by examining small business leaders' perceived attributes of cloud-computing innovation and their propensity to adopt emerging cloud-computing technology.

Problem Statement

Small businesses that do not embrace cloud computing forfeit the benefits attributed to its novel business-computing paradigm resulting in a competitive disadvantage that further threatens small businesses' sustainability and economic contribution (Armbrust et al., 2010, Marston et al., 2010). The general problem targeted was small businesses' slow embrace of technology innovations for greater economic and societal contributions. The specific problem researched in this study was the limited early adoption of cloud-computing innovation by small businesses for improved economic value. Adapting a resource-based view of IT to cloud computing, Truong (2010) reported that less than 2% of small businesses have employed a limited form of newly emerging cloud computing and further recognized the need to understand small businesses' potential use of cloud-computing technology. Modeling cloud-computing business macroeconomics, Etro (2009) forecasted improved small business economic contribution by simulating approximately 430,000 firm creations during a 5-year period using a rapid cloud computing adoption rate, which was more than five times the number of firm creations using a slow adoption rate.

Purpose Statement

The purpose for this quantitative study was to examine the relationship between small business leaders' perception of cloud-computing attributes and their propensity to adopt this emerging innovation. Applying predictive DOI theory, this objective was accomplished by collecting information from Arizona small business IT decision-makers through a previously tested online survey instrument that was designed to assess the adoption of IT during the prediffusion stage of innovation. To ensure an adequate response size, a convenience sample of Arizona small businesses was drawn from an entire e-mail list maintained by the Arizona Commerce Authority (ACA).

Constructs measuring the perceived attributes of cloud computing, which included the independent variables compatibility, complexity, observability, relative advantage, results demonstrable, trialability, and voluntariness, as well as the dependent variable intent to use cloud computing, were collected via the survey instrument. The data collected were analyzed using SPSS statistics to assess the relationship between small business leaders' perception of cloud-computing attributes and their intent to use this emerging technology. Based on a nonexperimental cross-sectional survey design, this research was not intended as an investigation of causation.

A better understanding of small business leaders' propensity to adopt cloud computing was envisaged to guide positioning of this emerging technology to foster rapid adoption translating into increased entrepreneurial startups and stimulating small business growth. Transcending economic value, contributions to social change were projected by potentially guiding policy practices for developing employee skills, initiating private and public sector collaboration, and anticipating the environmental consequences of computing.

Nature of the Study

A quantitative research method was elected for this doctoral research project. Rooted in a postpositivist worldview of determinism (Stacey, 2007), this inquiry was undertaken to understand the relationship between small businesses' perception of cloud-computing innovation attributes and their intent to adopt this emerging IT innovation. Beyond advancing prediffusion stage DOI research and providing a steppingstone for continued research linking cloud-computing technology to small business competitive advantage, the immediate anticipated benefit of this understanding was the potential for guiding the establishment of policies and other positioning influences related to cloud-computing innovation for more rapid adoption by small businesses. Targeting this outcome, study hypotheses were stipulated to address specific research questions based on Valier et al.'s (2008) theoretical model related to the adoption of IT during the prediffusion stage of the innovation process.

Quantitative analysis was performed using SPSS's statistical functionality consisting of bivariate linear regressions and multiple regression computations. The statistical functions performed were based on one dependent variable, the small business leaders' intent to use, and seven independent variables representing the perceived innovation attributes: relative advantage, compatibility, complexity, observability, trialability, results demonstrable, and voluntariness. The quantitative research method was well suited for deductively testing objective theories by empirically measuring and statistically analyzing variables to understand their relationships (Campbell & Stanley, 1963; Creswell, 2009; Onwuegbuzie, Johnson, & Collins, 2009).

Conversely, qualitative research methods are generally exploratory in nature, inductively seeking to construe the meaning about a phenomenon derived from participants' vantage (Creswell, 2009; Onwuegbuzie et al., 2009; Yin, 2009). In particular, Rogers (2003) reported that qualitative case studies have been effective in exploring postdictive DOI social system and change agent influences. Mixed methods research have been employed in other studies to combine the interdisciplinary strengths of deductive and inductive practices attributed to quantitative and qualitative epistemologies, respectively (Cassell, Buehring, Symon, & Johnson, 2006).

The inductive, open-ended exploratory aspect of the qualitative research method was not congruent with this doctoral study's predictive DOI research purpose, which was proposed to examine deductively the relationship between the prediffusion attributes of cloud-computing innovation and the intent of small businesses to adopt cloud-computing technology. Moreover, the added complexity of mixed methods research extended beyond the scope of this doctoral study's purpose. Neither qualitative nor mixed methods research were as well suited for this research study's bounded scope as a quantitative approach.

This research project was fashioned from a traditional quantitative cross-sectional survey design strategy that included four key elements: literature-based theoretical hypotheses and study variables, population sampling criteria, a single point of data acquisition via a survey instrument, and statistical data analysis and interpretation (Creswell, 2009). Although the conceptualization of cloud computing has its genesis in the framing of the Internet, cloud computing was viewed as a newly emerging IT arena (Buyya et al., 2009; Katzan, 2010; Louridas, 2010; Truong, 2010). The rationale for using a cross-sectional survey design approach was anchored in providing statistical inferences from measurement data collected at a specific point versus using multiple survey results collected over a period.

The quantitative survey design approach was chosen over a structured interview strategy to measure more efficiently and cost-effectively the requisite sample size in a timely manner (Bardhan, 2007; Creswell, 2009). Furthermore, this cross-sectional research design consisted of a web-based, self-administered data acquisition process.

Web-based survey tools have been employed in numerous IT-related surveys, offering benefits over traditional survey practices (Oke, Burke, & Myers, 2007, Maronick, 2009).

The use of a web-based survey tool was preferred as responses were received more quickly than with traditional mail methods while mitigating data entry errors encountered in recording hardcopy survey results. The use of an online survey tool was calculated to be lower in cost than the traditional mail methods because printing, mailing, and handling expenses are mitigated. Additionally, the use of a web-based survey tool benefited the participant by providing participant anonymity while capturing necessary informed consent, eliminating manual response remittance activities, and assimilating with modern experiences in electronic communication methods.

Arizona small businesses numbered approximately 106,800 firms in 2008 (U.S. Census Bureau, 2008). Based on the U.S. Census Bureau 19 industry-sector categorization, the top four numbering sectors, including construction, professional together with scientific and technical, health care and social assistance, and retail trade, comprised slightly over half the total number of Arizona small business. The study population of Arizona small businesses was derived from ACA's estimated 4,500 cross-industry sector e-mail addresses. Anticipating a small sample response rate of 3%, the number of survey participants was expected to include around 135 senior IT deployment decision-makers from Arizona small businesses. A study sample size of at least 117 participants was needed based on a priori goodness-of-fit G*Power calculation (Faul, Erdfelder, Buchner, & Lang, 2009). Based on the sampling method, cross-sectional survey, and other study elections, this research project was considered a nonexperimental quantitative design and was not intended as an investigation of causation. Additional information elaborating on the specific details related to this study's research method and design is presented in Section 2.

Research Questions

To address the problem statement and to achieve the objectives of this study's purpose, given small business volatility and economic importance, the overarching research question guiding this study was, "What is the propensity of small businesses to embrace the cloud computing novel business-computing paradigm?" The relationship between each of the independent variables composing the perceived attributes of cloud-computing innovation and the dependent variable intent to use cloud-computing technology were addressed by the following specific research questions (RQ).

RQ1: To what extent does relative advantage, a perceived attribute of innovation, relate to small business leaders' intent to use cloud-computing services?

RQ2: To what extent does compatibility, a perceived attribute of innovation, relate to small business leaders' intent to use cloud-computing services?

RQ3: To what extent does complexity, a perceived attribute of innovation, relate to small business leaders' intent to use cloud-computing services?

RQ4: To what extent does observability, a perceived attribute of innovation, relate to small business leaders' intent to use cloud-computing services?

RQ5: To what extent does trialability, a perceived attribute of innovation, relate to small business leaders' intent to use cloud-computing services?

RQ6: To what extent does results demonstrable, a perceived attribute of innovation, relate to small business leaders' intent to use cloud-computing services?

RQ7: To what extent does voluntariness, a perceived attribute of innovation, relate to small business leaders' intent to use cloud-computing services?

RQ8: Which has a stronger relationship to small business leaders' intent to use cloud-computing services the perceived attribute of innovation relative advantage or voluntariness?

The study focus, which was delineated by the research questions, was honed further via the hypotheses stipulated in the following section.

Hypotheses

Congruent with the postpositivist deterministic research paradigm, the hypotheses were a priori assumptions that were tested using statistical procedures as described in Section 2 to determine the existence, strength, and direction of the study's variable correlations (Creswell, 2009). An entire list of the survey questions is presented in Appendix A. Additionally, each survey question's contribution to the meaning of the variable constructs assessed via the hypotheses is identified in the Operational Definitions of Variables section. The following are the hypotheses related to the research questions assessed by this doctoral study.

Hypothesis 1

The first hypothesis (H1) was stated theorizing that, during the prediffusion stage, the higher the level small business leaders perceived the relative advantage of cloud computing the greater their propensity to adopt the innovation.

$H1_0$: No correlation exists between relative advantage and intent to use cloud computing.

H1a: Relative advantage is correlated with intent to use cloud computing.

Hypothesis 2

The second hypothesis (H2) was stated theorizing that, during the prediffusion stage, the higher the level small business leaders perceived the compatibility of cloud computing with extant factors the greater their propensity to adopt the innovation.

$H2_0$: No correlation exists between compatibility and intent to use cloud computing.

H2a: Compatibility is correlated with intent to use cloud computing.

Hypothesis 3

The third hypothesis (H3) was stated theorizing that, during the prediffusion stage, the lower the level small business leaders perceived the complexity of cloud computing the greater their propensity to adopt the innovation.

$H3_0$: No correlation exists between complexity and intent to use cloud computing.

H3a: Complexity is negatively correlated with intent to use cloud computing.

Hypothesis 4

The fourth hypothesis (H4) was stated theorizing that, during the prediffusion stage, the higher the level small business leaders perceived the observability of cloud computing the greater their propensity to adopt the innovation.

$H4_0$: No correlation exists between observability and intent to use cloud computing.

H4a: Observability is correlated with intent to use cloud computing.

Hypothesis 5

The fifth hypothesis (H5) was stated theorizing that, during the prediffusion stage, the higher the level small business leaders perceived the trialability of cloud computing the greater their propensity to adopt the innovation.

$H5_0$: No correlation exists between trialability and intent to use cloud computing.

H5a: Trialability is correlated with intent to use cloud computing.

Hypothesis 6

The sixth hypothesis (H6) was stated theorizing that, during the prediffusion stage, the higher the level small business leader perceived the results demonstrable of cloud computing the greater their propensity to adopt the innovation.

$H6_0$: No correlation exists between results demonstrable and intent to use cloud computing.

H6a: Results demonstrable is correlated with intent to use cloud computing.

Hypothesis 7

The seventh hypothesis (H7) was stated theorizing that, during the prediffusion stage, the more mandatory (i.e., less voluntary) small business leaders perceived the voluntariness of cloud computing the greater their propensity to adopt the innovation.

$H7_0$: No correlation exists between voluntariness and intent to use cloud computing.

H7a: Voluntariness is negatively correlated with intent to use cloud computing.

Hypothesis 8

The eighth hypothesis (H8) was stated theorizing that, during the prediffusion stage, small business leaders' perceived relative advantage of cloud computing was more strongly related to their propensity to adopt the innovation than the strength of relationship between their perceived voluntariness and propensity to adopt cloud computing.

$H8_0$: Voluntariness has an equal or greater correlation with intent to use cloud computing than does relative advantage.

$H8_a$: Relative advantage has a higher correlation with intent to use cloud computing than does voluntariness.

Theoretical Framework

The theoretical framework for this study was based predominately on the DOI theory. Commencing with his doctoral dissertation presentation in 1957, Everett M. Rogers has championed DOI research, culminating in his internationally acclaimed work *Diffusion of Innovation*, which had its fifth edition publishing in 2003. Rogers's (2003) research findings and generalizations related to DOI have been used as the theoretical framework for a multitude of studies examining the process of innovation communication via channels to members of social systems over time. Although the genesis of DOI grew out of various research traditions from the dawn of the 20th century (Rogers, 2003), the DOI framework has been widely embraced for studying the diffusion and adoption of IT and Internet innovations (Andrés et al., 2010; Häggman, 2009; Ross, 2010; Valier et al., 2008; Williams, Dwivedi, Lal, & Schwarz, 2009).

As an alternative to the DOI framework, Vega, Chiasson, and Brown (2008) proposed the systems of innovation approach (SIA) for understanding diffusion of complex innovation. Vega et al. described SIA as an organizational learning process influenced by social capabilities and acquired knowledge that shaped the development, diffusion, and use of innovations. Although cloud computing has been shaped by complex and emergent interactions, yielding new knowledge and intermediate innovations, the full depth and breadth of the SIA framework adds a degree of complexity not merited by this study's research questions. Recognizing the importance of these influences on DOI, social factors have been engineered into the research by refining the traditional measures related to the perceived attributes of innovation. Based on the study's findings, the potential for follow up SIA research may be warranted.

The traditional DOI framework has been contextualized by four main elements: innovation, communication via channels, time duration, and social system constituency (Häggman, 2009; Rogers, 2003). Silverstein, Samuel, and DeCarlo (2009) prefaced their conceptualization of innovation by describing innovation in the common terms of "introducing something new" or "coming up with the next big idea" (pp. xvii-xviii). Rogers's (2003) DOI research revealed that the rate of innovation adoption was determined by five variables: perceived innovation attributes, innovation decision types, communication channels, social system characteristics, and change agent effectiveness.

Suggesting strategies for cloud-principled computing technology innovation, Sahoo (2009) adapted the traditional DOI framework into a triune context consisting of customer context, industry-competitor context, and technical intricacies context. Sahoo's customer-value perspective context in conjunction with the technical intricacy context closely resembled Rogers's (2003) DOI construct for the perceived attributes of innovation while the industry-competitor context was analogous to Rogers's DOI social system characteristics construct. Similarly, for the purposes of this study, the primary DOI framework emphasis has been refined to focus on an expanded delineation of the attributes of innovation related to cloud-computing innovation in lieu of the traditional measures.

Understanding the perceived attributes of innovation has become a predominant focus of DOI research (Häggman, 2009; Rouibah & Hamdy, 2009; Valier et al., 2008; Vega et al., 2008). Rogers (2003) asserted, "The individual's [adopter or potential adopter] perceptions of the attributes of innovation, not the attributes as classified objectively by experts or change agents, affect its rate of adoption" (p. 223). In his DOI research, Rogers further distilled the perceived attributes of innovations to include *relative advantage*, *compatibility*, *complexity*, *trialability*, and *observability* (pp. 15-16). However, like other researchers, Rouibah and Hamdy's (2009) instant messaging adoption study and Chong, Ooi, Lin, and Raman's (2009) collaborative commerce (c-commerce) adoption inquiry limited the measures of innovation attributes to relative advantage, compatibility, and complexity.

In prominent diffusion research (Moore & Benbasat, 1991; Rogers, 2003; Venkatesh et al., 2003), relative advantage was emphasized as an essential innovation attribute in determining the adoption of IT innovations. Often expressed in economic value, societal significance, and other beneficial facets, the variable relative advantage was used to measure the perceived degree of betterment attributed to an innovation in lieu of precursor ideas (Rogers, 2003). Regularly associated with perceived usefulness, relative advantage within the context of this study was gauged by quickly performing tasks, improving quality, working easier, enhancing effectiveness, improving performance, and increasing productivity.

Compatibility was defined as a measure of the perceived degree of congruence attributed to the innovation based on the adopter's experiences, values, and needs (Rogers, 2003). Distinguishing compatibility as an essential innovation attribute measure for technology acceptance, Rouibah and Hamdy (2009) further calibrated compatibility as a measure of the adequacy of fit for the task the technology was intended to perform as well as culture in which it will be used. Consistent with Rouibah and Hamdy's meaning, compatibility within the context of this study was assessed by factors including compatibility with work, productivity, current situation, and work style.

Analyzing four determinates of c-commerce adoption: innovation attributes, environment, information sharing culture, and organizational readiness, Chong et al. (2009) emphasized the perceived degree of complexity as an important innovation attribute determinant. Although commonly associated with perceived ease of use, the variable complexity was defined as an assessment of the perceived degree of difficulty or simplicity attributed to understanding and using the innovation (Chong et al., 2009; Conrad, 2010; Rogers, 2003). Chong et al. and Rogers's (2003) meaning of complexity, which gauges factors such as cumbersome to use, understandability, performs as desired, and easy to learn, was deemed consistent with the purpose of this study.

Trialability was defined as a measure of the perceived ability for use inspection attributed to the innovation (Conrad, 2010) while observability is the perceived degree of communicability or visibility to others attributed to the innovation's use, features, or benefits (Rogers, 2003). Although Rouibah and Hamdy (2009) and Chong et al. (2009) eliminated these measures from their innovation adoption research, for this study both trialability and observability were considered important attributes of innovation for cloud computing based on the obstacles associated with cloud computing revealed in the literature review.

In the context of this study, Rogers's (2003) meanings of trialability and observability were applied. Rogers defined observability as a measurement used to examine other firms' use, other internal uses, the degree visible, and the ease of viewing other uses of the innovation. Additionally, Rogers defined trialability as a gauge of the opportunity for experimentation, knowing where to try, the ability to try, and the empowerment to try or experiment adequately.

Building upon the attributes of innovation research, Moore and Benbasat (1991) developed a generalizable survey instrument consisting of 25 scale items to measure eight attributes of IT innovations. The eight attributes consisted of a hybrid of Rogers's classic five plus three additional attributes. Moore and Benbasat's additional attributes included social variables: *image*, *voluntariness*, and *results demonstrable*. Image was described as the perceived degree of enhancement of one's social system status or prestige (Moore & Benbasat, 1991). Voluntariness was depicted as the perceived degree of self-determined sovereign choice to use an innovation (Moore & Benbasat, 1991).

Extending and superseding the theory of reasoned action (TRA), researchers' use of TAM has dominated IT and Internet inquiry related to ease of use and usefulness acceptance measures (Azadegan & Teich, 2010; Davis, 1989; Venkatesh et al., 2003). Moore and Benbasat embraced the influence of Davis's (1989) TAM research by integrating the construct *perceived usefulness* into the classic innovation attribute relative advantage and superseding the attribute complexity by the construct *perceived ease of use* (Moore & Benbasat, 1991; Rogers, 2003). Al-Hajri and Tatnall (2008) highlighted the variable ease of use as a focal measure driving Internet banking adoption. Moore and Benbasat (1991) further delineated the classic attribute observability by its distinct attributes of communicability and visibility resulting in the refined attribute measures of *results demonstrable* and *visibility*.

Researchers applying DOI theory typically have examined the rate of innovation adoption based on five variables. Researchers employing TAM primarily have correlated the constructs of perceived usefulness and perceived ease of use with the acceptance or rejection of technology, in particular IT. DOI researchers were concerned with innovations, technology based and otherwise, whereas TAM researchers are singularly interested in technologies. Davis (1989) defined perceived usefulness as the extent to which a person's belief that using a particular IT system enhances his or her job performance. Likewise, Davis defined perceived ease-of-use as the degree to which a person believes that using a particular system would be effortless or free of difficulty. TAM has been used extensively in research to examine user acceptance of various IT innovations (Al-Hajri & Tatnall, 2008; Gounaris & Koritos, 2008; Williams et al., 2009).

Expansive IT acceptability research has led to the proliferation of technology acceptance and adoption models. Venkatesh et al. (2003) evaluated eight prominent models related to an individual's intentions to use IT culminating in the unified theory of acceptance and use of technology (UTAUT). Venkatesh et al.'s UTAUT model consisted of four core variable determinates of technology acceptance and up to four moderating variables. Gounaris and Koritos (2008) emphasized Moore and Benbasat's (1991) usability attributes while also incorporating measurement factors related to the social and psychological aspects of the adoption process. While recounting the parsimonious attraction of the TAM framework, Straub and Burton-Jones (2007) suggested that UTAUT and other TAM adaptations are far from parsimonious having a bias for common methods variance. Straub and Burton-Jones called for comprehensive meta-analysis of TAM's independent and dependent variables, their relationships, and moderating factors reconstituting TAM into its essential parsimonious set of variables and critical antecedents.

Additionally, Compeau, Meister, and Higgins (2007) extended Moore and Benbasat's (1991) theoretical framework further transforming the variables compatibility and results demonstrability. Compeau et al. extrapolated the variable compatibility into three constructs: compatibility with prior experience, preferred work style, and values. Expressing concern related to the potential inability to distinguish between Moore and Benbasat's constructs for visibility and results demonstrable, Compeau et al. added clarity to visibility by emphasizing visibility of others' use and transforming the variable results demonstrability into two constructs: communicability and measurability.

As previously stated, Rogers's (2003) framework defining the variable compatibility and observability were preferred in lieu of Moore and Benbasat's (1991) and Compeau et al.'s (2007) framework related to these constructs. However, Moore and Benbasat's constructs for results demonstrable and voluntariness, which have a social context, were considered appropriate based on the marketing hype and policy mandates exposed in the literature review. For the purposes of this study, the construct for results demonstrable was defined to assess factors such as difficulty in telling others, sharing consequences, apparent outcomes, and explaining the rationale for use, while the construct voluntariness was defined to gauge indicators such as management's use expectation, adopter's choice, optional use, compulsory use, and preferences.

Acceptability research typically has been forward looking, investigating the ideal attributes of an innovation, to position the innovation for greater acceptance and, therefore, a more rapid rate of adoption (Rogers, 2003; Valier et al., 2008). As a point of reference, typical DOI research is intrinsically postdictive correlating present perceived attributes of innovation with the prior adoption rate of the innovation (Valier et al., 2008). In their diffusion of the Internet research analyzing longitudinal data collected over the period of 1990 through 2004 in 214 countries, Andrés et al. (2010) examined actual innovation adoption versus the potential for adoption signaling a traditional postdictive approach. Acknowledging that the number of producers engaged in offering an innovation has been used as a measurement of its diffusion, Andrés et al. measured diffusion based on user adoption that was more consistent with Rogers's (2003) DOI approach and the theoretical framework of this study.

Recognizing the postdictive nature of DOI research, Rogers (2003) advocated a prediction DOI research design that measured the attributes of innovation at an innovation's prediffusion stage ($time_1$), which is a time prior to, or concurrent with, an individual's innovation adoption decision, to predict its rate of adoption during future diffusion ($time_2$). Rogers favored this predictive research design strategy in lieu of (a) extrapolating the rate of adoption from a prior similar innovation into the future or (b) measuring the potential adopters' perceived attributes of a hypothetical innovation to predict its impending rate of adoption. Alternatively, Häggman (2009) demonstrated using the DOI framework as means of inductive inquiry related to adoption and diffusion of technology.

Compeau et al. (2007) deepened the conceptualization of predictive DOI research focusing beyond the direct effects of perceived attributes of innovation. Compeau et al. investigated the ways in which antecedents to innovation adoption operated to influence the behavior of innovation adoption and use. Evolving Rogers's (2003) perceived attributes of innovation through the lens of Moore and Benbasat's (1991) acceptance constructs, Compeau et al. developed a more refined set of variables to measure innovation adoption that undergirded their extended theoretical DOI model of indirect antecedent influences of innovation adoption. Compeau et al.'s extended predictive DOI model offered a greater scope than required for this study; their research further substantiated the direct effects of the independent variables examined in this doctoral research.

Conceived in Rogers's (2003) predictive DOI research assumptions, Valier et al. (2008) developed a theoretical model to test the predictive ability of DOI theory. Valier et al.'s predictive DOI model was used to examine, during the prediffusion stage, the correlation between seven perceived attributes of an innovation and the potential adopter's intent to use the innovation. The activities leading to the early adoption of an innovation, which signal the beginning of diffusion, encompass the prediffusion stages of the innovation-development process (Rogers, 2003). However, Valier et al.'s research limited prediffusion activities through the research and development stages, thereby excluding the commercialization stage. The conceptual series of the innovation-development stages depicting the predecessor role of the prediffusion stages is illustrated in Figure 1.

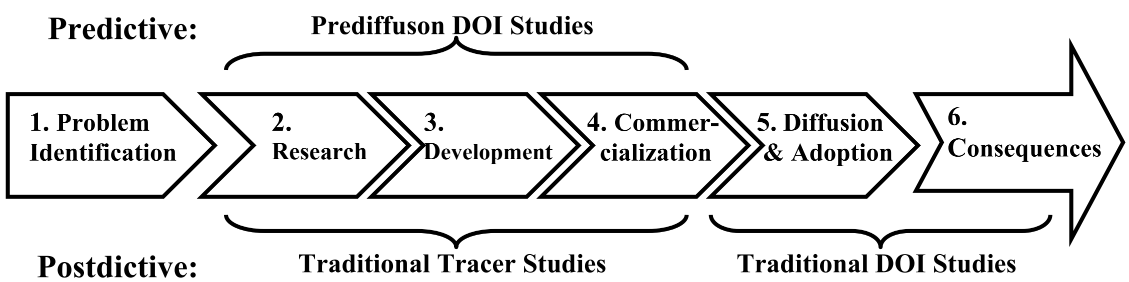

Figure 1. Theoretical sequence of activities in the innovation-development process. Adapted from "Diffusion of Innovation, 5th Edition" by Everett M. Rogers, 2003, The Free Press, Figure 4-1, p. 138. Copyright 2003 by Everett M. Rogers. Copyright 1983 by Free Press, a Division of Simon & Schuster, Inc. Reprinted with permission of the publisher per Appendix B. All rights reserved.

Constructed on the innovation research of Rogers (2003), Moore and Benbasat (1991), and Gounaris and Koritos (2008), Valier et al.'s (2008) predictive DOI model included the seven independent variables: relative advantage, compatibility, complexity, results demonstrable, trialability, observability, and voluntariness. The dependent variable in Valier et al.'s model consisted of intent to use, which was the outcome of the decision stage, the third of five stages, in the innovation-decision process (Rogers, 2003, p. 169). The innovation-decision process is illustrated in Figure 2.

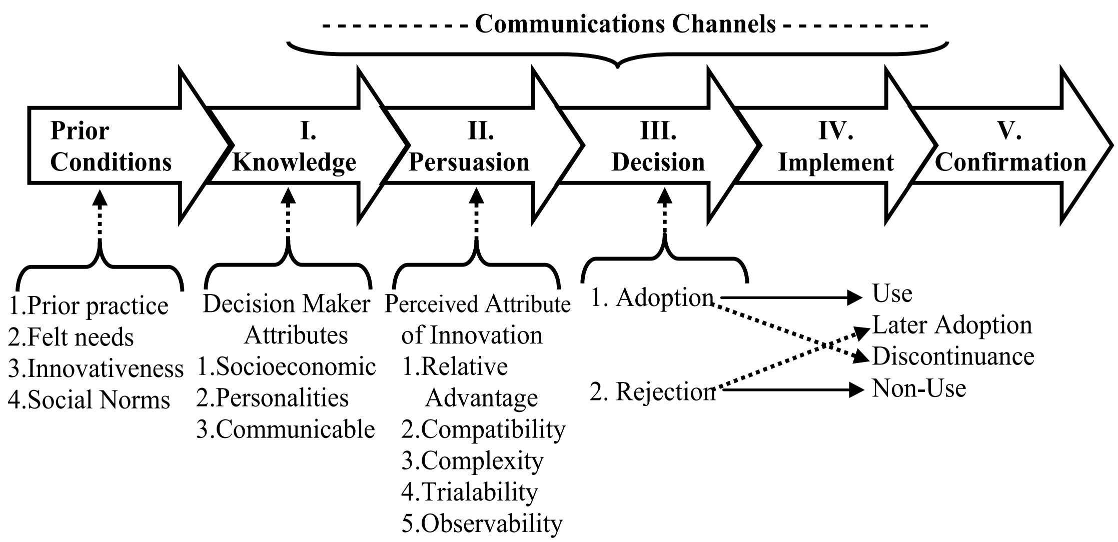

Figure 2. Theoretical continuum of decision-making activities in the innovation-decision process. Adapted from "Diffusion of Innovation, 5th Edition" by Everett M. Rogers, 2003, The Free Press, Figure 5-1, p. 170. Copyright 2003 by Everett M. Rogers. Copyright 1983 by Free Press, a Division of Simon & Schuster, Inc. Reprinted with permission of the publisher per Appendix B. All rights reserved.

Valier et al. (2008) successfully tested their predictive DOI model by measuring, during the prediffusion stage, the perceived attributes of open source software innovations and Linux User Groups World Wide members' use intentions. The theoretical framework applied to this doctoral study was adopted from Valier et al.'s predictive DOI model based on Rogers's (2003) four elements of DOI. In this instance, the four elements of DOI were applied as follows:

1. The innovation was emerging cloud-computing technologies.
2. The channels of communications were both formal and informal.
3. The timeframe was prediffusion through the commercialization stage.
4. The social system included the Arizona small business sector.

Gounaris and Koritos (2008) extended the innovation-attributed framework combining measures of usability associated with TAM, attributes of innovation characteristic of DOI, and social and psychological measures. Using a logistic regression, Gounaris and Koritos analyzed the relationship of the various measurement factors and the predictability of Internet banking adoption. Gounaris and Koritos's research closely resembles the predictive DOI model used by Valier et al. (2008).

Additionally, this study's independent and dependent variables were adopted from Valier et al.'s (2008) predictive DOI model. The independent and dependent variables were examined to test empirically the hypothesis derived from this study's research questions. The independent variables were defined to assess the perceived attributes of cloud-computing innovation, which included relative advantage, compatibility, complexity, results demonstrable, trialability, observability, and voluntariness. Consistent with the predictive DOI model, these independent variable measurements reflected the potential adopter's perceptions versus those of industry experts or DOI researchers. The dependent variable, intent to use, was defined to assess small business leaders’ propensity to adopt cloud-computing innovation. Operationalized definitions of the study variables are stipulated in the Data Collection segment in Section 2.

Although the innovation-development process featured in Figure 1 depicted a series of sequential stages, Rogers (2003) affirmed that the timing, occurrence, and iteration of stages were not uniform for all innovations because of reinvention and other factors influencing the process. Cloud-computing innovations have fluctuated between the development processes with standardization of services yet fully defined for commercialization. Cloud computing was envisioned as utility-like commercialization demonstrating rapid elasticity of measured services that were not generally available to all potential adopters. The theoretical framework for this DOI inquiry is illustrated in Figure 3 depicting the research, development, and commercialization stages of the innovation-development process.

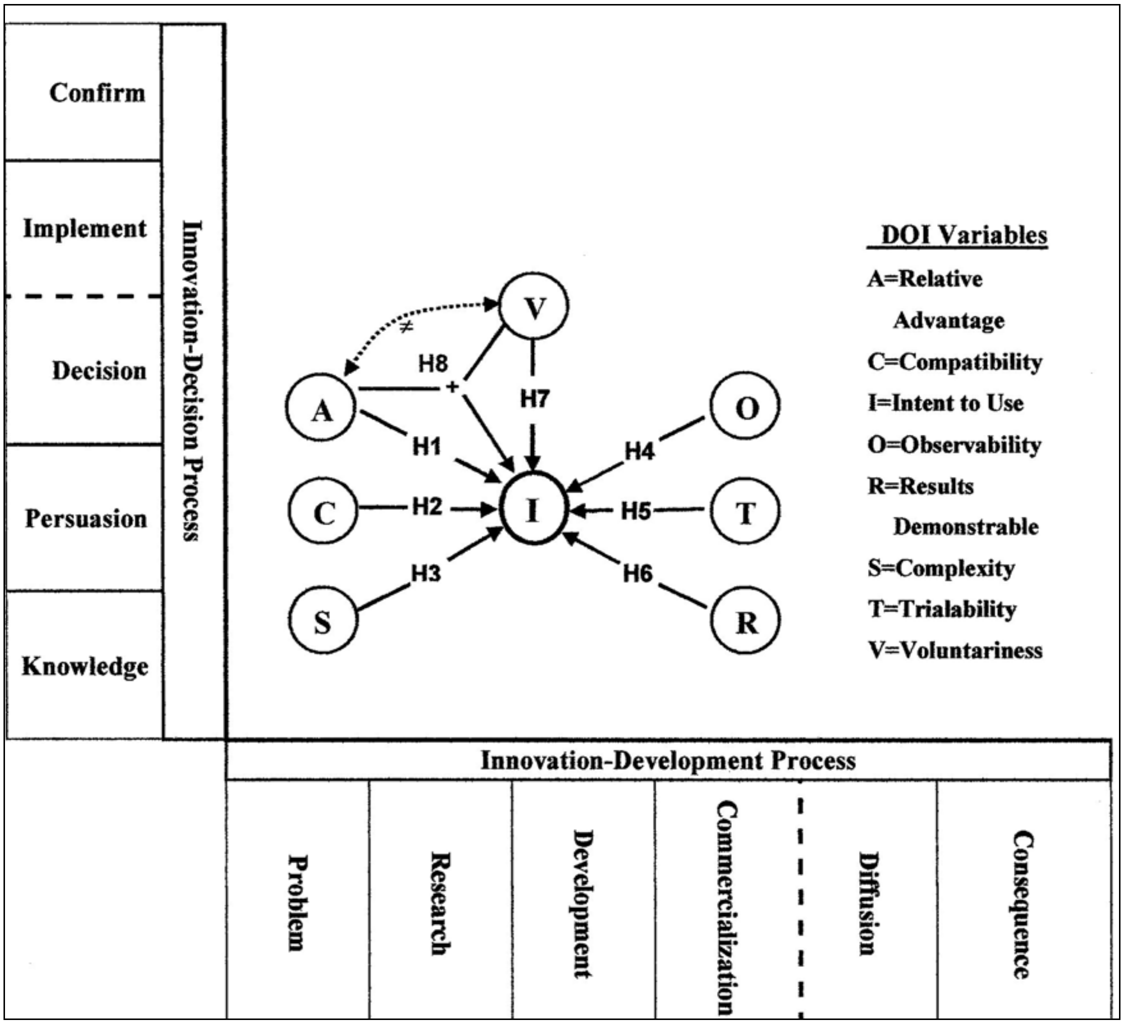

Figure 3. Theoretical predictive DOI framework. Framed in context of the innovation-development and innovation-decision processes, the perceived innovation attributes were related via the hypotheses to the potential adopter's use intention. The innovation-development process and innovation-decision process were adapted from "Diffusion of Innovation, 5th Edition" by Everett M. Rogers, 2003, The Free Press, Figures 4.1 & 5-1, pp. 138, 170.

Definition of Terms

This study was framed on concepts and terminology centric to Internet and cloud-computing technology that may be unfamiliar to the reader. A brief description was provided explaining the meaning for each key technology term.

Broad network access: Extensive connectivity and usability via standard mechanisms supporting heterogeneous thin or thick client platforms (Mell & Grance, 2010).

Cloud computing: Large, scalable, on-demand, rapidly provisioned, IT assets and capabilities ecosystem connected with and available through the Internet including networks, servers, storage, applications, and services (Cheng, 2010; Mell & Grance, 2010; Smith, 2009).

Community cloud: A cloud infrastructure collectively supporting organizations that have a shared affinity, concerns, or purpose (Mell & Grance, 2010).

Competitive advantage: A position of strategic benefit acquired by a firm in relation to its competitors (Porter, 1998).

Diffusion: The process of innovation communication via channels to members of social systems over time (Rogers, 2003).

Information technology: The management of computer-based information systems relating to software applications and computer hardware used to convert, store, protect, process, retrieve with security, or transmit any information (Information Technology Association of America, 2009).

Infrastructure as a Service (IaaS): The provision of managed processing, storage, networks, and other fundamental computing resources for consumer deployment of software including operating systems and application software via the Internet (Mell & Grance, 2010).

Innovation: The embodiment, combination, or synthesis of knowledge or an idea related to relevant products, processes, services, or other objects that are perceived by its adopter as novel and potentially value adding (Crespell & Hansen, 2008; Rogers, 2003).

Innovation-development process: The innovation life-cycle continuum of activities and decisions that transpires commencing with the perception of a problem need through research, innovation development, commercialization, diffusion and adoption, and consequence (Rogers, 2003).

Internet: The global information system that (a) is logically linked by a globally unique address space based on the Internet Protocol (IP) or its subsequent extensions; (b) can support communications using the Transmission Control Protocol/Internet Protocol (TCP/IP) suite or its subsequent extensions, or other IP-compatible protocols; and (c) provides, uses or makes accessible, either publicly or privately, high-level services layered on the communications and related infrastructure (Federal Networking Council, 1985).

Hybrid cloud: A cloud infrastructure comprising two or more clouds (private, community, or public) that is bound together by standardized or proprietary technology that enables data and application portability (Mell & Grance, 2010).

Measured Service: The transparent provisioning, metering, and accounting of an abstraction of computing resources in accordance with a service level commitment (Mell & Grance, 2010).

On-demand self-service: A consumer's unilaterally provisioned computing capabilities as needed without requiring service provider human interaction (Mell & Grance, 2010).

Platform as a Service (PaaS): The computing capability deployed onto the cloud infrastructure consisting of programming environments, virtualization, layered interfaces, and other development tools supplied and maintained by the service provider enabling consumers to use created or acquired applications via the Internet (Mell & Grance, 2010).

Prediffusion: The activities in the innovation-development process leading to the commencement of diffusion, which is signaled by the first adoption of the innovation (Rogers, 2003; Valier et al., 2008).

Private cloud: A cloud infrastructure operated exclusively for a sole organization (Mell & Grance, 2010).

Public cloud: A cloud infrastructure commercially available to the general public or a large industry group (Mell & Grance, 2010).

Rapid elasticity: The seemingly infinite dynamic and immediate provisioning of computing resources that scales (up or down) to instant consumer demand (Mell & Grance, 2010).

Resource pooling: The autonomous dynamic multi-consumer sharing of computing assets or components (Mell & Grance, 2010).

Software as a Service (SaaS): The provision of supplier managed application programs to consumers hosted on a cloud infrastructure (Katzan & Dowling, 2010; Mell & Grance, 2010).

Service Oriented Architecture (SOA): An open standard based on loosely coupled components and a functional architecture that allows the integration and interoperability of different applications by different members of an IT ecosystem (Sahoo, 2009; Vouk; 2008).

Small business: A size classification of business entities organized for profit. In the United States, the SBA established small business size standards on an industry-by-industry basis as a function of annual revenues or number of employees, which typically include firms employing fewer than 500 employees and generating revenues below $50 million (SBA, 2007).

Sustainability: To establish and maintain economic, environmental, societal viability for the present as well as the future (Senge, Kruschwitz, Laur, Schley, & Smith, 2008).

Assumptions, Limitations, and Delimitations

The assumptions, limitations, and delimitations related to this research study were disclosed to enhance reviewer comprehension as well as to inform further research about this study's methods, conclusions, and findings. The assumptions were defined to recognize unconfirmed facts considered true that may beget potential risks. The limitations were revealed to highlight known areas of restrictions potentially exposing areas of study deficiency. The delimitations were defined to delineate the study's scope and boundaries.

Assumptions

The first assumption warranting disclosure posited that the IT agility, efficiency, and economic benefits attributed to large organization's early adopter use of emerging cloud-computing innovation similarly would be experienced by small businesses, thus resulting in their increased economic viability and sustainability. Process agility, computing scalability, outsourced technology competency, economies of scale, and operationalized costs were identified in the literature review as rationale for large company and public agency early adoption of the yet fully commercialized cloud-computing innovations. Although large-firm practices are not necessarily transferable to small businesses (Galán, Monje, & Zúñiga-Vicente, 2009; Tan, Fischer, Mitchell, & Phan, 2009), the large enterprise cloud-computing innovation benefits were anticipated applicable.

Another assumption was that the individuals from small businesses participating in this study had sufficient understanding of emerging cloud-computing technology to record their perceptions regarding its innovation attributes. Although cloud-computing technology may not be fully evolved through the research and development and commercialization stages of the innovation-development process continuum, cloud-computing innovation has been sufficiently conceptualized and communicated via formal and informal channels. As a result, small business participants were believed informed sufficiently to conceptualize perceptions about the cloud-computing innovation attributes.

To add clarity, cloud-computing innovation terminology was specified in the study survey instrument to mitigate risks associated with this assumption.

A related assumption was that of participant self-reporting bias, which is influenced by societal and cultural norms expressed via personal feelings and attitudes. Moreover, self-reporting bias occurs when a participant's experience, self-perception, and work environment influence their survey responses (Han & Anantatmula, 2007). Participant self-reporting bias was mitigated by soliciting honest and objective participant survey responses.

Limitations

A common limitation of DOI research has been a pro-innovation bias. This phenomenon in DOI research was conceptualized as a predetermination that the subject innovation should be adopted and spread rapidly throughout all members of the targeted social system without consideration of re-innovation or rejection (Rogers, 2003). A pro-innovation bias has limited researchers' vision to overlook or underemphasize innovation rejection, discontinuance, or re-invention as well as to avoid antidiffusion inquiry.

The rationale for the selection of cloud-computing technology as the innovation of interest for this DOI research mitigated the pro-innovation bias. Specifically, the preliminary research conducted to uncover and understand the problem as stipulated for this research study evidenced the meritorious IT agility and economic value of cloud-computing innovation while recognizing its embryonic development. The re-inventive nature related to certain aspects of cloud-computing technology was a driving factor in the election of its prediffusion study emphasis.

The prediffusion emphasis, which included the innovation-development stages leading to the innovation adoption decision, of this study was narrowed by its predictive focus. Consideration of the adoption rate, adoption consequences, or other influences associated with innovation diffusion was excluded because of this study's predictive emphasis. These additional innovation diffusion considerations may delineate the scope of further inquiry beyond this research study. Additionally, Valier et al. (2008) recognized the predictive methodological approach as potentially limiting the appropriateness of causal relationship analysis.

Another potential limitation of this study was related to the practical limitations in assembling a list of the entire Arizona small business sector as a whole. The population sampling frame elected was convenience sampling (Creswell, 2009) based on the entire small business e-mail list maintained by the ACA. As a result, generalization of the study's findings was limited potentially to the study population and was not implied beyond. The potential convenience sample limitations were mitigated to a degree by the anticipated increased sample size.

Delimitations

The problem statement, theoretical framework, and research design have been instrumental in determining the scope and bounds related to this research study. The delimitation discussed in this study proposal included four factors: innovation election, innovation measurement, population sample selection, and data collection and analysis. The boundaries associated with these delimitation factors were used as a guide to identify what was in and out of the project scope.

After a preliminary scan of emerging technology innovations, cloud-computing innovation's meritorious business computing paradigm was revealed as a potential means for greater small business economic contribution. Although this insight potentially reinforced a pro-innovation bias, the potential economic and societal benefits warranted further investigation to understand small business leaders' propensity to adopt cloud-computing innovation relative to its perceived innovation attributes. This DOI research project was delimited by the specific innovation of interest, which was cloud-computing technology.

Encompassing a wide range of exploratory possibilities spanning the six stages of the innovation-development process continuum, the five stages of the innovation-decision process spectrum, and the five variable determinants of the rate of adoption, DOI research has been extensively embraced (Rogers, 2003). This predictive DOI research project was delimited by the prediffusion stages in the innovation-development process continuum, the decision stage in the innovation-decision process spectrum, and the perceived attributes of innovation in the determination of the rate of adoption arena.

The DOI social system of interest was delimited to the small business sector. More specifically, Arizona small businesses delimited this study's subject scope. Based on the research design, data collection was performed during a 10-day period using a cross-sectional online survey. Additionally, quantitative statistical methods delimited the data analysis conducted. These study delimitations, in whole, composed this distinctively unique research study.

Significance of the Study

This study's significance was demonstrated by reducing the gap identified in extant research concerning small businesses' penchant to adopt cloud-computing innovation and by recognizing the potential implications for positive social change. The research gap reduction was prefaced by a recap of extant research deficiency. The implications for social change extended beyond small business sustainability affecting economic, societal, and environmental benefits.

Reduction of Gaps

The value and volatility of small businesses in the U.S. economy and free enterprise capitalism has permeated the literature. The importance of IT and innovation adoption for competitive advantage in support of small businesses' sustainability was broadly evidenced throughout scholarly research. However, the review of the literature revealed a deficiency in understanding about the propensity of small businesses to adopt emerging cloud-computing innovation, relative to the relationship of perceived cloud-computing innovation attributes and adoption intent. This research has strengthened the potential for increased small business economic viability and sustainability via the increased understanding about the relationship of small businesses' perceived cloud-computing innovation attributes and their intent to use this emerging innovation.

Building on the framework of prior DOI research, this research was conducted to address the literature gap by examining small businesses' propensity to adopt cloud-computing innovation. More specifically, this study's findings revealed the correlation of small businesses' prediffusion perception of cloud-computing innovation attributes in conjunction with the intent to use cloud-computing technology. A limited number of studies have been conducted based on the prediffusion stage of innovation adoption while the preponderance of DOI research has been conducted during and post innovation adoption. Filling this void in the literature provided a steppingstone for continued research linking cloud-computing technology to small business competitive advantage and sustainability.

Implications for Social Change

Business sustainability was defined as a triune conceptualization consisting of (a) making present choices that do not compromise future choices, (b) enhancing the economic well-being, and (c) respecting the ecological and societal carrying capacity (Senge et al., 2008; Will, 2008). A better understanding of small businesses' potential use of cloud-computing innovation holds the possibility of reducing small business failures, increasing their economic contributions, and promoting sustainability. Furthermore, this study's findings and added understanding was anticipated to transcend the benefits of business sustainability by potentially guiding policy practices for elevating employee job skills, improving private and public sector collaboration, and increasing the U.S. gross domestic product and U.S. global innovative leadership (Estrin, 2009).

Small businesses may use this study's findings to improve capitalization of IT innovations for sustainability. These findings were anticipated useful for projecting employee development proficiencies in preparation for deploying cloud-computing innovations. Local communities were expected to benefit from these findings by understanding the importance for educating the nascent workforce related to developing cloud-computing technology skills. Regulatory and public agencies were anticipated to develop better insights related to assisting small business employers with needed technology innovation collaboration support to facilitate academic and public sector technology commercialization (Blau, 2009; Renski, 2009; Rosser & Taylor, 2008). Additionally, rapid diffusion of cloud-computing innovation has the potential for significant positive environmental impact via the reduction of overall energy consumption and electronic equipment disposal waste shifting the burden from nature (Senge et al., 2008, pp. 199-200).

A Review of the Professional and Academic Literature

The literature reviewed for this research project was organized into five topical areas. The first topic area was small business perspectives, which identified current trends and information relative to small business statistics, economic contributions, global impact, and closures. The second topic area was small business innovation policy, which surfaced trends in small business innovation collaboration, governmental intervention, and academic influences. The third topic area was small business innovation essentials, which revealed the criticality of business innovation, the strategic role of innovation, and trends in small business innovations. The fourth topic area was small business IT innovation, which focused on small business IT and Internet innovation practices. The fifth topic area was cloud-computing ecosystems, which presented a conceptualization of this rapidly evolving technology emphasis.

Although printed book publications were included in the literature review, the main literature search was conducted via electronic databases, primarily EBSCOHost's

Computers and Applied Sciences Complete and Business Source Complete/Premier, ProQuest's ABI/INFORM Complete and Business Dissertations and Theses, and Emerald Management Journals. Keywords used for the electronic database search of the topic domains included

- *business sustainability*, *entrepreneur*, *small business*, *U. S. economy* for small business perspectives;
- *collaborative commerce*, *diffusion of innovation*, *economic policy*, and *technology transfer policy* for small business innovation policy;
- *competitive advantage*, *innovation*, *technology invention*, *pre-adoption*, and *product development* for small business innovation essentials;
- *e-business*, *e-commerce*, *Internet*, and *IT strategy* for small business IT innovation; and
- *cloud computing*, *grid computing*, *service computing*, *utility computing*, and *virtualization* for cloud-computing ecosystems.

A total of 152 resources were found relevant, eight of them were books, two of them were dissertations, seven of them were government publications, and two of them were online references. The remainder was peer-reviewed journal articles. A map of the literature reviewed is presented in Appendix C to communicate the literature's basis for establishing ongoing inquiry and research.

An understanding of the importance of small businesses in the United States and to the global economy was developed based upon the literature review. This understanding included factors affecting the efficacy of small businesses as well as enabling influences that foster innovation in small business. Additionally, current motivations and strategies regarding the innovation practices of small business were explored. Last, the rapidly evolving presence of cloud computing was examined as a potential ecosystem for novel small business innovation to facilitate sustainable competitive advantage.

Small Business Perspectives

The literature review concerning small business perspectives was highlighted to build an understanding of current trends and information relative to small business mass and economic contributions, small business global impact, and small business closure or discontinuance volatility. The SBA has recognized the critical importance of small business to the United States' economic strength and its role in the global marketplace. Since its establishment in 1953, the SBA (2009) has served and protected the interests of small business concerns to preserve free competitive enterprise. Based on 2008 data, the SBA (2009) reported that the more than 27 million small businesses in the United States represented 99.7% of all employer firms, generated 60 to 80% of net new jobs annually, and created more than one half of the nonfarm private gross domestic product.

The U.S. statistics were similar to those reported relative to comparable free enterprise markets. In Australia, small businesses accounted for 96.7% of total business numbers employing 70% of the total workforce (Quaddus & Hofmeyer, 2007; Scupola, 2009). In Europe, small businesses numbered 23 million and account for 99% of all European businesses (Blau, 2009). The similarity of these statistics depicted small businesses' global economic significance.

Defining exactly what constituted a small business was challenging. Sovereign governing bodies throughout the world have established unique criteria for designating a firm's size. The U.S. federal government has stipulated a business' size as a function of annual revenues or number of employees based on the North American Industry Classification (NAIC) system (Small Business Act, 1979). The maximum qualifying annual revenue varies from $750 thousand to $50 million and the maximum number of employees ranges from 100 to 1,500 depending on NAIC designation (SBA, 2007). Although in the United States small businesses typically included firms employing fewer than 500 employees and generating revenues of $50 million or less, small businesses were reported to comprise nearly all U.S. employers, employ the majority of the private sector workforce, and create the greater part of the gross domestic product (SBA, 2009).

The executive arm of the European Union defined small and medium size enterprises (SMEs), which were comparable to U.S. small businesses, as independent companies with fewer than 250 employees (Blau, 2009). In Australia, small businesses were designated as firms employing 200 or fewer workers (Scupola, 2009). However, in New Zealand SMEs were considered firms with fewer than 20 employees (Al-Qirim, 2007). These various definitions created ambiguity in identifying small businesses with consistency throughout the literature. Universally, SMEs have been characterized as catalytic economic agents with relatively limited resources and broad diversity (Forsman, 2008).

To counteract the decline in the United States' leadership role in technology due to fewer workers and entrepreneurs entering careers in competitive science, technology, engineering, and mathematics (Rosser & Taylor, 2008), strengthening and expanding small businesses' innovation capabilities has been defined as a top priority (Galston, 2010; Heffes, 2009; SBA, 2009). In 2008, the European Commission approved the EU Small Business Act, which was designed to help small businesses and entrepreneurial startups to develop innovative capacity as a means of closing its research gap with the United States (Blau, 2009). Barba-Sánchez and Martínez-Ruiz (2009) emphasized European SMEs' contribution to regional employment and social-economic development. Li and Mitchell (2009) recognized the competitive dynamics of the Chinese knowledge worker spillover as a model to stimulate radical small business innovation in transitional economies. In comparison, small businesses in the United Kingdom's more developed economy have been predisposed to focus more on leveraging return on investments, thus favor incremental versus radical innovations (Oke et al., 2007). Additionally, Uddin's (2006) study of innovations diffusion in Bangladesh offers an important consideration for incremental change leading to sustained small business development globally. These global considerations for small business innovation and technology leadership demonstrated the economic value of small business innovations.

Kampschroeder, Ludwig, Murray, and Padmanabhan (2008) exposed the adverse rippling economic fallout of failed small businesses. Faced with large-company and global competition, small businesses have experienced high discontinuance rates: 76% of new firms remain open after 2 years, 47% after 4 years, and 38% after 6 years (Liao et al., 2008; SBA, 2009). Likewise, Tan et al. (2009) reported that somewhere between 50% and 80% of small businesses fail.

At the state level, year-to-date third quarter 2008 Arizona small business discontinuances outpaced new ventures by 13.75% and small business contractions exceeded expansions by 44.7% (SBA Office of Advocacy, 2009). Nonfarm Arizona small business employers in 2006 made up approximately 1.8% of U.S. small business employers (SBA, 2009). During the 2006 timeframe, Arizona small business employers numbered approximately 107,500 firms, accounted for 97.4% of the state's employers, and employed 48.8% of the state’s private-sector workforce (SBA, Office of Advocacy, 2009). More recently, the U.S. Census Bureau (2008) reported that Arizona small businesses numbered approximately 106,800 firms, reflecting a decline in small business economic vitality.

However, equating small business closure with business failure was misleading. Bates (2005) reported that according to U.S. Bureau of the Census survey data, approximately 37% of Year 6 firm closures were deemed successful at the time that the decision was made to cease operations. Understanding the rationale for small business discontinuance was an important consideration in their economic contributions. A resource-based view of nascent entrepreneurs revealed that financial resources and technology knowledge were salient factors in business discontinuance (Liao et al., 2008). However, the literature review exposed a gap in knowledge in relation to cloud-computing innovation and small business adoption for economic sustainability.

Small Business Innovation Policy

The literature review in connection with small business innovation policy explored the rationale for governmental intervention, investigated academic knowledge transfer influences, and highlighted business collaborative trends in small business innovation. Recognizing the commercialization value of small businesses for public sector research, U.S. federal policy established the Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) programs. SBIR and STTR programs collaboratively team private sector expertise via small business entrepreneurs and innovative university research with public sector funding to maximize return on investment for research, foster innovation leadership, and stimulate economic development (Ford, Shino, Sander, & Hardin, 2008).

Similarly, state government and local municipal public policies such as ACA's Angel Investor and Enterprise Zone programs promoted local and regional economic development via collaborative public assisted research and small business commercialization (ACA, 2011). ACA is a newly established quasi-public state authority governed by a board of directors comprising public and private sector members envisioned to foster an operating environment for strategic collaboration and economic growth. Emphasizing small business and entrepreneurship, ACA's strategies were aimed at diversifying the overall state economy by incubating and bringing in new businesses. Often these policies have resulted in agglomeration of research and small business incubation clusters further leveraging economies of scale and network effects (Maine, Shapiro, & Vining, 2010).

Although government intervention aimed at information and communication technologies (ICT) in rural economies was designed to foster regional small business sustainability and growth, government-provided Internet technology to rural communities appeared to stifle regional entrepreneurship as a result of greater competitive access to rural communities (Cumming & Johan, 2010). Analyzing the multiscalar innovation and development research-center frameworks in North America, Clark (2010) recommended horizontal and vertical coordination policy within national innovation systems evidencing the overall value attributed to innovation commercialization as an economic policy intervention. Government policy intervention was intended to serve as a catalyst and resource for small business innovations (Michael & Pearce, 2009).

Likewise, university-based research centers have fostered commercialization of innovation via small businesses to leverage the economic value of their research and to further academic pursuits. For example, the Center for Advanced Technology and Innovation pioneered a unique technology-led economic development strategy in Southeastern Wisconsin to foster rural small business innovation transfer (Wagner, 2008). Similar research centers designed for commercialization of technology innovation have emerged in other global regions. For example, Finland has established its global competitiveness by retaining economic value of homeland production through academic research technology transfers bringing together technology, design and small business to develop innovative products (Cervi, 2008).

An important motive for collaborative small business innovation was to create economies of scale for market share benefit (Allen & Stearns, 2009; Carree & Thurik, 2008). Allen and Stearns (2009) highlighted small businesses in rural communities successfully competing with urban centers via regional innovation and technology entrepreneurship collaboration. Similarly, the Organization for Economic Co-operation and Development (OECD) has fostered sustainable economic growth, advanced employment, and promoted individual living standards by lobbying democratic governments and market economies to develop economic cooperatives that innovatively and competitively cultivate small business development (Carree & Thurik, 2008). In recent years, the European countries have developed collaborative economic policies based on economic regional development models to stimulate the creation and expansion of small and medium-sized companies in synergistic industries (Barba-Sánchez & Martínez-Ruiz, 2009). Another motivation for innovative collaboration was the byproduct of operational efficiencies and cost savings generated through small business business-to-business (B2B) trading exchanges and information sharing (Quaddus & Hofmeyer, 2007).

Throughout the Cold War era of the mid-to-late 20th century, private and public research centers in the United States collaboratively launched a technological revolution that has reshaped the way people live, work, and play, and have built the most advanced communications, computing, and scientific technology in the world (Estrin, 2009). However, changing regulatory and market driven policies have reconstituted the once mammoth and broad R&D center into more narrowly focused, cost-conscious innovative strategies, thus eroding the innovation ecosystem. To capitalize on the economic value associated with their innovation and market agility, small businesses have benefited from governing policies compensating for their capital limitations (Etro, 2009), thus decreasing their susceptibility to discontinuance (Liao et al., 2008). Further research was deemed necessary to understand better small business collaboration relative to cloud-computing adoption and sustained economic advantage, whether it is B2B, governmental, or academic.

Small Business Innovation Essentials

The literature was reviewed related to small business innovation essentials exploring the critical aspect of business innovation for survival, the strategic role of innovation in small businesses, and trends in small business innovation. Commonly understood in today's global economy and competitive environment, a firm must innovate or it will perish (Silverstein et al., 2009). This phenomenon has been conceptualized by the theory of economic development as the process of creative destruction, suggesting that innovative business activities are attributed to economic growth and sustainability (Gúzman-Cuevas, Cáceres-Carrasco, & Soriano, 2009). Sharpening differences between firms versus reducing them, IT innovation has been shown to complement business management ability to achieve rapid process innovations (McAfee & Brynjolfsson, 2008).

The vitality of American culture and free enterprise has been sustained by the ideals of innovation, exploration, freedom, and renewal (Estrin, 2009). In their extensive review of the literature related to small business research, Tan et al. (2009, p. 234) concluded that small businesses were at the *center of action* in technology and innovation. The various aspects of innovation have emphasized product, process, market, supply chain, and industrial organization (Porter, 1998). Understanding the ability to measure innovation as well as the enablers of innovation has been paramount in recent research (Braganza et al., 2009; Mangelsdorf, 2009; Rogers, 2003). This understanding holds true for large companies and small businesses alike (Dibrell et al., 2008) even though Welsh and White (1981) recognized that a small business is a distinct innovation agent and not merely a *little big business*.

Although the majority of family owned firms were small businesses, Ibrahim et al. (2008) reported that 34% of the companies listed on the *Standard and Poor's 500* were family operated businesses that typically outperformed nonfamily firms. Ibrahim et al.'s research revealed that family owned small businesses typically developed unique strategies, which were linked to attributes conducive to innovation deriving competitive advantage. Although small businesses typically were nimbler, more customer-oriented and quality focused, and more active in the community (Ibrahim et al., 2008), Galán et al. (2009) noted that small businesses experienced more trouble than larger firms in enduring under hostile environmental conditions, suggesting other factors constrain their sustainability.

Countering the intensified small business challenges attributed to recent complex and turbulent economic assaults (SBA, 2009), Ribeiro-Soriano and Urbano (2009) advocated leveraging the benefit of collaborative entrepreneurship. Ribeiro-Soriano and Urbano's integrated innovation and knowledge management approach was framed by three dimensions: a shared collaborative projects strategy, adaptability via collaborative environmental structure, and a management philosophy consisting of shared values and trust. Galán et al. (2009) further identified how the constraints hindering small business during difficult times were transformed or leveraged into strategic innovations for competitive advantages. Likewise, Will (2008) advocated a corporate foresight strategy to transfer methods of predictive and technology analysis to the small business context for sustainable development, small business management, and strategic innovation. These strategies and others portrayed innovation as a core small business objective.

However, Forsman (2008) claimed that there were many unanswered questions regarding small business development projects relative to improved business performance. Forsman further posited that the small business innovation projects seemed to exhibit several interrelated dimensions; success propelled upward while failure spiraled downward. As an explanation to this phenomenon, small businesses' competitiveness typically depended on innovation resourcefulness while larger organizations emphasized a resource-based view minimizing the innovation risk (Hewitt-Dundas, 2006). In this context, small businesses that offered technology-based, knowledge-intensive business services (T-KIBS) or large network-based service achieved innovation based more on professional knowledge while other small business service firms conformed to supplier-driven innovations (Miles, 2008). Moreover, small businesses often engaged T-KIBS firms to deploy business technologies such as enterprise resource planning (ERP) systems as a source of innovative competitive advantage (Sledgianowski, Tafti, & Kierstead, 2008). Ultimately, developing new products and services was among the highest innovation concerns for all firms including small businesses (Vermeulen, Van Den Bosch, & Volberda, 2007).

Small Business IT Innovation

The literature review included a survey of the current understanding relative to small business IT innovation focus as well as Internet IT innovation practices. Crespell and Hansen (2008) identified that small business innovation was often achieved by adoption or synthesis of existing technology resulting in a new process, capability, product, or service for the firm. Crespell and Hansen further recognized that the small businesses' propensity to innovate was predicated in their organizational culture and work climate. Organizational culture generally was descriptive relating to the common set of shared meanings among employees about goals, problems, and practices while work climate typically was contextualized as the organization's policies and routines as perceived by employees (Kaplan & Norton, 2004). Moreover, Benitez-Amado, Llorens-Montes, and Perez-Arostegui (2010) analyzed the relationship among market performance, technological IT and managerial IT resources, and intrapreneurship culture, which embodied a working environment infectious with creativity, innovation, and entrepreneurship. Benitez-Amado et al. found that IT resources had a positive effect on intrapreneurship that in turn was a predictor of firm market performance indicating competitive advantage.

Additionally, Qureshil et al. (2009) reported that SMEs adopted IT and ICT to enable competitive advantage evidencing that IT-dependent initiatives resulted in creating and sustaining value. Qureshil et al. further suggested that the ICT competitive advantage was applicable to micro enterprises as well. Although McAfee and Brynjolfsson (2008) argued that the link between technology and competition has become much stronger since the mid-1990s, they concluded from their research that (a) IT sharpened competitive distinction, (b) executive leadership positively correlated with IT-enabled value, and (c) IT-intensive competitiveness was continuous. As further evidence of IT-enabled firm value, Oh and Pinsonneault's (2007) empirical study related to resource-centered and contingency-based IT strategies indicated that investments in growth-oriented IT applications exhibited a positive correlation to firm profitability, which is at the heart of competitive advantage. The literature further revealed specific uses of IT for operational efficiency and focused strategic initiatives.

Specifically, Archer, Wang, and Kang (2008) researched the barriers related to the adoption of online supply chain management by Canadian SMEs. Archer et al. recognized the benefits of using shared IT capabilities by small businesses for effective supply chain decisions illustrating the use of IT innovation to create upstream and downstream collaboration for competitive advantage. Correspondingly, Al-Qirim (2007) examined the adoption of e-commerce, communications, and application technologies innovation by small businesses in New Zealand. Al-Qirim's research indicated that the small business executive's Internet IT innovativeness was a primary determinant for adoption of external-e-mail, intranet, virtual private network (VPN) extranets, and websites. Similarly, unprecedented acceleration of competition within the U.S. economy was triggered by the mid-1990s mainstream adoption of the Internet, enterprise software, and other IT innovations (McAfee & Brynjolfsson, 2008).

E-business, which comprises e-intelligence, e-commerce, and e-collaboration, has become an accepted process capability with more than 45% of Canadian firms possessing some form of e-business capability (Raymond & Bergeron, 2008). For example, the emergence of Internet banking capabilities has revolutionized the IT innovation strategies of banks and financial industry firms striving for competitive market advantage in developed and many developing countries (Al-Hajri & Tatnall, 2008). While e-commerce has become a basic banking staple, Al-Hajri and Tatnall (2008) indicated that Internet banking adoption is attributed to perceived ease of use, functionality perceived as a relative advantage, projected operational efficiency improvements, and anticipated customer relationship enhancement. Employing a strategic typology that included prospectors, analyzers, and defenders, Raymond and Bergeron (2008) found positive performance outcomes for small business manufacturers in terms of growth, productivity and financial performance when the firm's e-business capabilities was in alignment with the firm's strategy. In essence, the e-business innovation potential resided in strategically aligned IT capability versus merely in the technology innovation.

Additionally, Dibrell et al. (2008) recognized that small businesses were sophisticated adopters of IT as a competitive tool to facilitate strategy and build core competencies. Evidencing this sophistication, Chalhoub (2010) investigated the adoption of innovative practices undergirded by intellectual capital and social networks developing a theoretical model based on the relationship between technological and process innovation as well as leadership performance. Cenfetelli, Benbasat, and Al-Natour (2008) further suggested shifting the firm's IT strategy from internal management tools to customer-directed Internet applications (i.e., business-to-customer e-commerce) to facilitate innovation of core competencies. Correspondingly, Doherty and Terry (2009) studied the relationship of IT resources and IT capabilities, which were described in constructs of tangible and intangible IT assets, yielding sustainable competitive advantage. Doherty and Terry found that *outside-in,* customer driven IT initiatives, and *spanning*, complementary internal and customer driven IT initiatives, were highly correlated to sustainable improvements in competitive positioning. Although Dibrell et al. (2008) concluded that synergistic integration of technology with product and process improvements enhanced small business performance, limitations in their study suggested additional research to show the correlation of Internet IT innovation to small businesses' sustainability.

Cloud-Computing Ecosystem

The literature was investigated to discern the rapidly evolving presence of the cloud-computing ecosystem as a foundation for exploring its potential use in fostering small business innovations. The conceptualization for cloud-computing innovation has been traced back to 1969 with the pioneering contributions of Leonard Kleinrock, a chief scientist with the Advanced Research Projects Agency Network (ARPANET) that incubated the Internet (Buyya et al., 2009). The Internet, commonly portrayed as *the cloud*, has evolved into a global communication network. The Internet provides the connectivity infrastructure for shared hardware and software technologies as well as enables ubiquitous access to these technology assets. The deployment of scalable, rapidly provisioned, and metered IT assets and computing capabilities ubiquitously accessible via the Internet is known as cloud computing (Cheng, 2010; Smith, 2009). In other words, cloud computing was portrayed as the manifestation of "the long-held dream of computing as a utility" (Armbrust et al., 2010, p. 50) that was proclaimed "the new frontier of the Internet era" (Etro, 2009, p. 179).

The National Institute of Standards and Technology (NIST) depicted cloud computing in the context of five essential characteristics, three service components, and four deployment approaches (Mell & Grance, 2010). The cloud-computing essential characteristics were featured as on-demand self-service, broad network access, resource pooling rapid elasticity, and measured services. The service components consisted of software as a service (SaaS), platform as a service (PaaS), and infrastructure as a service (IaaS). These service components were typically organized in a layered service oriented architecture whereby IaaS was the lowest layer comprising hardware and networking components; SaaS was the highest layer consisting of user interfaces and application functionally; and PaaS was an in-between layer comprising virtualization, operating systems, databases, application program interfaces (APIs), and other service platforms. Last, the deployment approaches included private, community, public, or hybrid cloud strategies. Each of these cloud-computing aspects was further delineated in the Definition of Terms section.

Emerging in a seemingly boundless environment, the genealogy of cloud computing was cited as evolving via the linage of open source software (Dwivedi & Mustafee, 2010; Sharif, 2010). Open source software was a significant enabling factor in cloud-computing feasibility attributing to the practicality of its vision as the fifth utility. Although open source software was a dominant force in IaaS operating systems and PaaS programming and database environments, open source software is rapidly emerging in SaaS via open source projects aimed at enabling enterprise IT applications and mobile technology applications (Dwivedi & Mustafee, 2010; Vescuso, 2010).

Cloud computing is uniquely distinct from super computing capabilities that have been proprietary to large scale data centers typically funded and controlled by government, academic research centers, and the largest corporate enterprises. Traditional computing and IT was designed to support an enterprise scale while cloud computing was envisaged via a broader Internet scale (Etro, 2009). Cloud computing was based on a global scale ecosystem model for the ubiquitous rapid provisioning of on-demand, shared-access, technology resources such as networks, servers, computers, storage, applications, and other IT services (Katzan, 2008, 2010; Mell & Grance, 2010, 2009; Truong, 2010).

The cloud-computing ecosystem conceptualization illustrated in Figure 4 was devised as consumable computing services based on virtual, networked, and recursive layering of hardware and software technologies (Armbrust et al., 2010; Blaskovich, & Mintchik, 2011; Etro, 2009; Katzan, 2010). Cloud computing was foreseen as the fifth utility following water, electricity, gas, and telephony; whereby the Internet functions analogous to electric or telephone connection and transmission lines (Buyya et al., 2009). Although Katzan (2008) drew a distinction between cloud computing and traditional utility computing, the capital investment requirements of large-scale IT capability are operationalized via the cloud-computing pay-for-use scheme for global rapid provisioning of seemingly infinite on-demand IT services (Mell & Grance, 2010; Rodero-Merino et al., 2010).

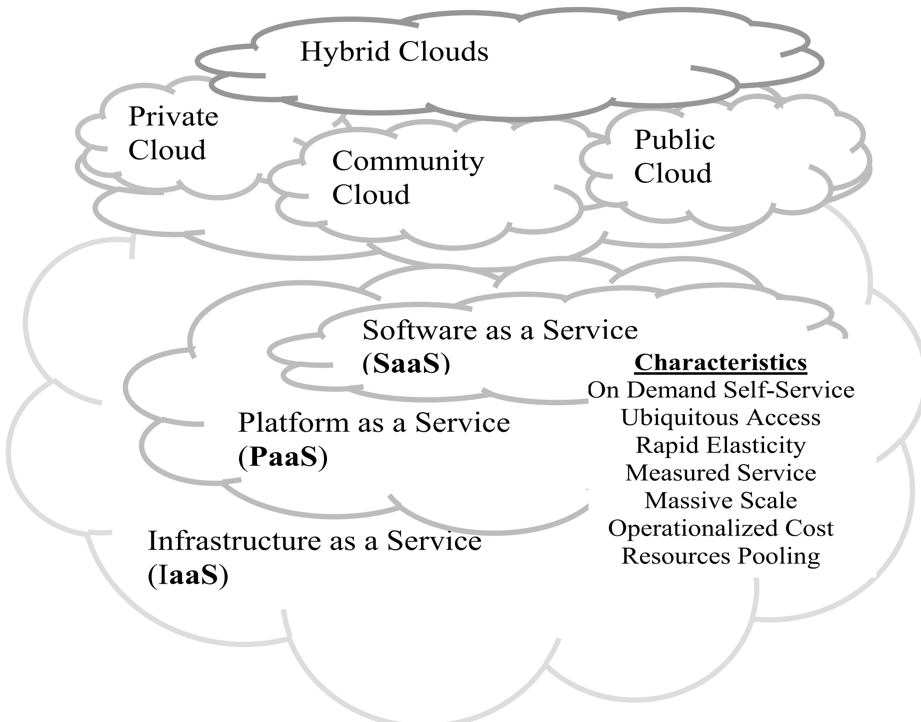

Figure 4. Cloud-computing ecosystem depicting deployment and service models. The conceptualization comprised various deployment models (private, community, public, and hybrid) and service models (SaaS, PaaS, and IaaS). SaaS provides applications and the user interface; PaaS provides virtualization, operating systems, databases, and layered interfaces; and IaaS provides servers, networking, data storages, and other computing hardware. The ecosystem model was adapted from "Effectively and Securely Using the Cloud-Computing Paradigm," by Peter Mell and Tim Grance, 2009, National Institute of Standards and Technology. Published by the United States Federal Government.

While delineating cloud computing as merely hardware-as-a-service (HaaS) and referencing SaaS and SOA as independent technology innovations, Sahoo (2009) formulated an IT innovation model for evaluating these emerging technologies based on three contexts: customer value perspective, industry market sustainability, and technology intricacies. Counter to Sahoo's viewpoint, Vouk (2008) asserted that SOA is an essential underlying and enabling architectural construct of cloud computing functioning in conjunction with virtualization and workflow management.

Brynjolfsson, Hofmann, and Jordan (2010) suggested that the analogy of computing services in the clouds (i.e., via the Internet) is not as simplistic as other utility services. Katzan and Dowling (2010) portrayed cloud computing as a utility conceptualized by service democratization including ubiquitous availability, optimal resource sharing, and consumer demand provisioning. Utilities such a water, natural gas, electricity are typically standardized products delivered to end user consumers catalyzing other innovations. Cloud computing entails a wide range of services and delivery models evolving at the rate of Moore’s law; thus, utility-like solutions have not been universally considered well suited to cloud-computing challenges (Brynjolfsson et al., 2010).

Rodero-Merino et al. (2010) proposed a unique consumer abstraction interface, named *Claudia*, for the diverse and evolving cloud-computing ecosystem to address the utility-like provision challenges. Similarly, Goscinski and Brock (2010) devised the resources via web services framework (RVWS) to offer a higher-level abstraction of cloud resource offerings. The RVWS model featured provisioning of cloud computing based on the current dynamic state and characteristics of cloud services and resources (Goscinski & Brock, 2010) while Claudia featured mobility amidst the universe of disparate cloud forms (Rodero-Merino et al., 2010). Goscinski and Brock depicted the macro level design of RVWS to include dynamic brokering, stateful and dynamic web service definition language (WSDL) documents, web service resource framework, dynamic attributes, and resource connectors. Rodero-Merino et al. described Claudia in the context of a service abstraction layer atop a cloud infrastructure manager.

Beyond Claudia and RVWS, Manzalini, Minerva, and Moiso (2010) envisioned the CASCADAS (component-ware for autonomic situation-aware communications, and dynamically adaptable services) project as an autonomic approach for cloud computing. Relying on complex adaptive systems (CAS) for the self-organizing administration of network of networks (NoNs), the CASCADAS project was a prototype of the autonomic communication element (ACE) abstraction that was at the heart of managing the complexities of the cloud-computing service ecosystem. Manzalini et al. (2010) described ACE as empowered with the duties of fault finding, configuration, maintenance, and performance optimization, thus autonomically reducing anomalies and improving efficiency. These capabilities were considered the DNA for the data revolution inherent in the next forecasted generation of the Web, which is known as Semantic Web (Web 3.0).

The feasibility for cloud computing resides in the projected computing capability and efficiency experienced via economy of scale and scope synergies in response to the amalgamation of fluctuating demands and commitment levels (Buyya et al., 2009; Katzan & Dowling, 2010; Truong, 2010). Emphasizing cloud-computing capabilities as a fundamental change in the management of computing needs, Han (2010) illustrated novel applications for cloud computing to enhance voluminous capabilities in library asset management. The economic feasibility of cloud computing was most evident when the alternative computing strategies require significant initial fixed capital costs, thus resulting in greater initial economic value (Etro, 2009). The practicality of off-the shelf rapid deployment of cloud-computing services enhanced its viability and feasibility as well (Truong, 2010).

The financial advantages of cloud computing have become recognized by chief financial officers (CFOs) as an enticing business model (Ford, 2010; Marston et al., 2010). Economies of scale derived from centralized, shared computing resources have spawned price pressure commoditization deemphasizing business requirement culminating in undisclosed risks of other service limitations to maintain price competiveness (Durkee, 2010). However, the use of cloud-computing innovation has not abdicated business responsibilities centric to intellectual rights, licensing, regulatory, and privacy compliance.

The service level agreement (SLA) has been designed to disclose risks and hidden costs, thus leveling the market space based on price performance that is essential for widespread commercialization of cloud computing (Durkee, 2010). In contrast to smaller organizations, large organizations with existing IT capabilities were reported as savvier and having greater negotiating power in garnering business model and end user experience conformance (Ryan & Loeffler, 2010). However, Hayes (2010) asserted that dominate cloud-computing service providers are less interested in negotiating the provisions of their SLA versus merely leveraging its basic market appeal.

Sharif (2010) reported that the commercialization and adoption of cloud-computing innovation was not merely based on its economic and shared technology advantages emphasizing consumer centric drivers. Although cloud computing has fostered innovations in the IT industry, its innovation potential was anticipated to emerge through novel business paradigms connecting and engaging people, thus effecting a virtualized economy (Katzan, 2008; Sultan, 2010). The average transaction in the virtualized economy typically involved upwards of 20 entities amidst various regulatory and currency systems imposing increased accountability mandates (Ford, 2010). Although small businesses traditionally have been late adopters of emerging technologies, Sharif forecasted that the emergence of the cloud-computing virtual economy would dissolve IT and other barriers distinguishing large and small businesses.

Various standards such as solution deployment description (SDD), configuration description, deployment, and lifecycle management (CDDLM), open virtual format (OVF), and other IT practice specific governance methods have served to enable cloud-computing innovations (Rodero-Merino et al., 2010). However, the emerging cloud-computing ecosystem subsists as an embryonic evolution pending universal governance of consumption standards, metering accountability, provisioning capability, and risk mitigation (Armbrust et al., 2010; Buyya et al., 2009; Vouk, 2008). Although several large companies have invested in building cloud-computing technology infrastructures, only a few pioneering firms have entered the market to offer cloud-computing services (Etro, 2009; Louridas, 2010). Obstacles related to early cloud-computing adoption have been expressed including perceived proprietary lock-in, data security risks, software licensing, and fault tolerance concerns (Armbrust et al., 2010; Louridas, 2010; Rodero-Merino et al., 2010).

Russell, Yoon, and Forgionne (2010) attributed cloud-computing availability and reliability apprehensions to its increased architecture and infrastructure complexity as well as to the multitude of potential Internet access failure points. Performance modeling and service level agreements have been used to mitigate these concerns (Russell et al., 2010). Other issues related to fragmented and dispersed data-based assets have influenced cloud-computing performance; thus, incubating novel data access methodologies such as *MapReduce* facilitating parallel data retrieval, processing, and storage (Lin & Dyer, 2010; Louridas, 2010).

The perceived benefits and obstacles associated with cloud computing were extracted from the review of the literature (Armbrust et al., 2010; Bennett, 2009; Braude, 2008; Buyya et al., 2009; Cheng, 2010; Katzan, 2008, 2010; Katzan & Dowling, 2010; Louridas, 2010; Mell & Grance, 2009; Russell et al., 2010; Schadler, 2009; Truong, 2010; Vouk, 2008), thus predominately reflecting the perception of industry experts versus the perception of potential adopters of cloud-computing innovations, in particular potential small business adopters.

The perceived benefits associated with adoption of cloud-computing innovations based on the literature review included:

- Cloud-computing services are typically on demand and rapidly deployed.
- Cloud-computing services are provisioned real-time based on consumer-initiated demand exhibiting elasticity.
- Cloud-computing services offered lower initial capital costs as compared to alternates.
- Cloud-computing costs are operationalized via pay-for-use metering.
- IT competencies for infrastructure, platforms, and applications are outsourced.

- The Internet provided ubiquitous global access to cloud-computing services.
- Cloud-computing services offered seemingly infinite massive and rapid scalability.
- Increased economies of scale and scope via pooled shared resource utilization lower overall cost.

The perceived obstacles associated with adoption of cloud-computing innovations based on the literature review included:

- Large-scale bandwidth is required for data transfers in data-based cloud-computing technology.
- Private or propriety cloud-computing technology may result in data lock-in.
- Reduced availability and dependability concerns due to increased failure points including Internet reliability.
- Increased vulnerability concerns due to security threats and data confidentiality breaches in shared ecosystem.
- Heightened noncompliance concerns with existing diverse software licensing requirements.

Despite the issues related to cloud computing, large organizations are evidencing early adoption of cloud computing for application such as e-mail, calendaring, human resource information systems (HRIS), customer resource management (CRM), e-commerce, and other common utility applications (Bennett, 2009; Schadler, 2009). Hayes (2010) asserted that the more mission critical an application was considered; the more likely apprehension was perceived about cloud-computing technology. Moreover, Hayes reported that a 2009 IDC survey of 691 IT executives across the Asian Pacific revealed that 11% of the respondents surveyed used cloud-based technology in some form while 64% of those surveyed perceived significant deficiencies in cloud computing with the remainder lacking an adequate understanding about cloud computing.

Large corporations such as Google, Amazon, IBM, and Microsoft have emphasized cloud computing in their innovation strategies as cloud-computing service providers (Bennett, 2009; Braude, 2008; Buyya et al., 2009; Russolillo & Tibken, 2010; Smith, 2009). In contrast, large public sector organizations such as the IRS, Veterans Administration, 2010 U.S. Census, and other government agencies initially have embraced private cloud computing for rapid deployment of massive scale shared applications (Mell & Grance, 2009; Sharif 2010; Wyld, 2009). These large government agencies were portrayed as viewing the advent of cloud computing as an emergency escape from the evident inadequacies and obsolescence inherent in their antiquated legacy computer systems and IT applications, which are burdened with massive ongoing operational costs.

Economic downturns have created business pressures inducing executive administrative mandates to use cloud-computing technology and have been largely responsible for federal government agency adoption of cloud-computing technology ("Federal Govt," 2010; Kundra, 2010; Mell & Grance, 2009). Only 34% of the federal agencies surveyed in the "Federal Govt" (2010) study reported lacking familiarity with cloud computing. Although 14% of those surveyed indicated using some form of cloud computing, 21% of the cyber-security professionals indicated lacking awareness about cloud computing (“Federal Govt.,” 2010).

The U.S. Department of Health and Human Services (HHS) decided to implement cloud-computing innovations in response to administrative mandates to reduce costs and streamline medical records processing (Chatman, 2010; Kundra, 2010). Health and Human Services perceived the relative advantage of rapid deployment, scalability, lower capital costs, and adjunct IT expertise while expressing concern over medical records security and privacy. Another example, the Virtual Computing Laboratory (VCL) based at North Carolina State University has established a research-based cloud-computing pilot project linking its college campuses and other out-of-state IBM virtual computing initiative member universities (Vouk, 2008). Although the literature revealed significant advantages for adopting cloud computing including economies of scale, provision elasticity, and massive-scale computing capability (Davis, 2009; Braude, 2008; Smith, 2009), research related to small business use of cloud computing for innovation is virtually nonexistent.

Recent studies (Buyya et al., 2009; Etro, 2009; Gens et al., 2010) have predicted slow initial adoption of cloud-computing innovation followed by aggressive accelerated adoption and cloud computing utilization. Using a dynamic stochastic general equilibrium (DSGE) calibrated model augmented with endogenous market structures, Etro (2009) conjectured, with a measured degree of uncertainty, the forecasted growth in European GDP because of the macroeconomic impact of cloud-computing innovations. Etro extrapolated these GDP predictions into the creation of more than 430,000 SMEs and thousands of new jobs for the 25 European countries studied based on five industry sectors: manufacturing, wholesale and retail trade, hotels and restaurants, transport storage and communication, and real estate renting and business activities.

Gens et al. (2010) forecasted similar emergence in cloud-computing commercialization with global public cloud-computing services projected to reach $55.5 billion by 2014, representing a 27.4% compounded annual growth rate from its 2009 $16 billion level. When compared to the 5% forecast in traditional IT growth, the forecasted cloud-computing growth rate is more than five times as rapid capturing over 12% of the total traditional IT market by 2014 and consuming approximately one third of the total new IT investments, which is anticipated to disrupt extant IT market leadership (Gens et al., 2010). As cloud-computing adoption becomes more globally widespread, Gens et al. forecasted a reduction from the U.S. dominance in public cloud-computing revenues measured at more than 70% in 2009 to approximate 51% by 2014 indicating increased cloud-computing adoption in Europe and developing countries.

Mobile computing devices ranging from the netbook, personal data assistants (PDAs), and a myriad of smart phones have rapidly become a portal to the utility of cloud-computing innovations (Greengard & Kshetri, 2010). In developing economies, mobile computing and cloud-computing innovations have achieved entrepreneurial economic contribution bypassing the traditional IT development lifecycle. Greengard and Kshetri (2010) illustrated the development of iPhone apps using virtualization in Nairobi, Kenya, where iPhone service is not yet available and local computing resources are limited. Although the relative advantage of cloud computing for small business was expected to be significant (Buyya et al., 2009; Etro, 2009; Gens et al., 2010; Greengard & Kshetri, 2010), specificity relative to the adoption of cloud-computing innovation by U.S. small businesses, in particular Arizona small businesses, for sustained economic vitality is lacking.

Transition and Summary

The challenges relative to small business sustainability that threatens free enterprise economy were acknowledged via a discussion of the research problem. The importance of the gestation and diffusion of IT innovations for small business economic vitality were recognized in the literature review. Based on its novel business-computing paradigm, the emergence of cloud-computing innovation has evidenced the potential for even greater economic value and societal benefit. A deficiency was surfaced via the literature review in knowing small businesses' propensity to adopt cloud-computing technology. This research project has investigated this deficiency by examining the relationship between small businesses' perceived cloud-computing innovation attributes and their adoption intent. This investigation was optimally suited for a quantitative cross-sectional survey design to address the hypotheses stemming from the research questions postulated. The following Project section is presented to detail more fully the research method and design, population and sampling scheme, data collection process, data analysis techniques, and the study's reliability and validity. Additionally, the study results and findings as well as their application to professional practice and implication for social change are presented Section 3.

Section 2: The Project

The Project section was stipulated to delineate the mechanics of the research study including how the study was conducted, what activities were performed, and other study parameters. Preceding the discussion of the project's internal mechanisms, the research study purpose is revisited to reinforce the emphasis and rationale for this inquiry. Additionally, the role of the researcher is described in support of the study's purpose and in rendering the resultant findings. The specific project inner-workings included the subject participants, the research method and design, the study population and sampling scheme, data collection process, data analysis techniques, and the study's reliability and validity.

The process of gaining access to, involvement with, and assurance for study participants' ethical safeguards is documented in the Participants section. Originating in the logical problem statement genesis, the distinctiveness of the designated research method and design are further clarified in the Research Method and Design section. The population characteristics and study relevance are disclosed in conjunction with its derivative sampling scheme in the Population and Sampling section. The study's measurement instrument, its application, and the items measured as well as the survey instrument's reliability and validity are delineated more fully in the Data Collection subsections. The quantitative analysis of the study data in context with the research questions and supporting hypotheses are identified and discussed in the Data Analysis section. Last, the reliability and validity of the study, including the study instrument, are assessed in the Reliability and Validity section.

Purpose Statement Revisited

The subject area of interest for this inquiry was the propensity of small businesses, given their economic importance and volatility, to adopt emerging cloud-computing innovation. In this doctoral study, the problem researched was the limited early adoption of cloud-computing innovation by small businesses for improved economic value. The purpose for this inquiry was to understand the relationship between the perceived attributes of cloud-computing innovation and the propensity for adoption by small businesses. Anchored in a predictive DOI theoretical framework, this research was devised to examine the intention of Arizona small business leaders to use emerging cloud-computing technology for obtaining the benefits associated with its novel business-computing paradigm.

This objective was accomplished by employing a quantitative cross-sectional survey research method soliciting input from IT deployment decision-makers from a sample of Arizona small businesses. Employing Valier et al.'s (2008) survey instrument, participant information was solicited based on a convenience sample of small businesses derived from Arizona Commerce Authority's e-mail list. Valier et al.'s pretested survey instrument was administered in an online manner via the Internet collecting measurements of the participants' perception about cloud-computing innovation attributes as well as their propensity for cloud-computing technology adoption. The perceptions of the innovation attributes were equated to the independent variables: compatibility, complexity, observability, relative advantage, results demonstrable, trialability, and voluntariness. The dependent variable, intent to use, was framed in the construct of the participant's propensity to adopt cloud-computing technology.

The participant survey response data were analyzed using SPSS's statistical functionality. Once the survey data were collected, descriptive statistics procedures were performed to reveal the composition of the study data. Cronbach's coefficient alpha and factor analysis procedures were performed to reaffirm the instrument reliability and validity. Analysis was performed to ensure a normally distributed dataset as a basis for testing the statistical relationship between each independent variable and the dependent variable. Bivariate regression analysis was employed to assess the strength of correlations between the independent variables and the dependent variable. Multiple regression analysis was employed to assess the strength of relationship between multiple independent variables and the dependent variable.

The goal of the inquiry, data collection, and data analysis was to understand better the prospect of cloud-computing innovation adoption by small businesses, potentially enhancing their economic vitality. The findings from this investigation, which are addressed in Section 3, highlight the potential for small businesses to capitalize on the forecasted economic value of cloud computing as well as other societal contributions. Transcending the benefits of small business economic value, the anticipated societal contributions included the potential for guiding policy practices for developing employee job skills, improving private and public sector collaboration, and improving the environmental consequences of computing.

Role of the Researcher

The involvement by the researcher in the data collection process originated with the stipulation of the study population and sample criterion based on the research problem and associated research questions, thus establishing a portion of the study's boundedness (Creswell, 2009). Beyond the population sample provisioning, the researcher's role during the data collection process in a quantitative study employing a self-administered survey instrument typically necessitates less direct participant interaction than with other quantitative research designs or in a qualitative methods study. One of the predominant characteristics of qualitative research is that the researcher is a key instrument in the data collection process (Creswell, 2009). Qualitative research is by nature interpretive; it typically requires the personal involvement of the researcher as an observer or even as an observer participant. Whereas the quantitative researcher, engaging minimal participant contact, establishes empirical measurement instruments and procedures engaged in collecting study data required to deduce analytical conclusions.

Described in detail in the Methods and Design section, this doctoral research project was modeled after a quantitative cross-sectional survey design using a participant self-administered Internet survey capability. The role of the researcher during the data collection process was limited to the following activities:

1. The researcher performed the setup and configuration of the Internet-based self-administered survey instrument, complete with positive affirmation of ethical disclosure and consent acknowledgement.

2. By e-mail invitation facilitated via ACA announcement, the researcher solicited the participants' anonymous engagement to complete the survey.
3. The researcher retrieved the anonymous survey responses for subsequent analysis.
4. The researcher responded directly to participant questions and concerns via e-mail and telephone.

Possessing more than 20 years of experience, the author of this doctoral study has gained industry expertise in the field of IT strategy. In this capacity, the researcher has worked directly with IT technologists, senior executives, and boards of directors for small businesses, large companies, and the public sector as well. Specifically, the researcher has facilitated and measured increased organizational capacity, improved operational efficiency, and lowered operating costs accredited to strategically aligned IT innovations. More information about the researcher was presented in the Curriculum Vitae appended to this research study. This experience enhances awareness, knowledge, and sensitivity to many of the challenges and issues centric to strategic IT innovations as well as IT agility for business continuity. Although conscious effort was made to ensure objectivity, the possibility of researcher bias existed potentially affecting the data collection and interpretive analysis activities. Because of the limited researcher role during the data collection process, the researcher's experience related to strategically aligned IT practices was not perceived to pose a material bias to this study.

Participants

The field of interest for this research consisted of Arizona small businesses, which included firms with fewer than 500 employees and earning less than $50 million annually. In 2008, Arizona small businesses accounted for nearly all of the state's employers and slightly under half of its private sector employees (SBA, Office of Advocacy, 2009). The preferred individual from each sampled small business to participate in the online survey was the IT deployment decision-maker, which may be the chief technology officer (CTO).

Creeger (2009, 2010) recognized the strategic role of the CTO in evaluating, understanding business application, and adopting emerging technologies. The CTO typically engages in formal and informal networks sharing and exchanging technology developments. The CTO's role was attributed to technology innovation decision-making, or at a minimum recommending innovation for adoption. The CTO typically has access to innovation communication channels, is considered a leadership change agent, and is astutely cognitive of their corporate and industry sector (social system).

Rogers (2003) cited studies in which an individual, such as a director, reported his or her perception of innovation attributes as a construct for an organizational unit of measurement and analysis. The CTO's role uniquely aligned with the five variables associated with determining the rate of adoption of an innovation, thus qualifying as a well eligible candidate for participating in this research survey process. However, many small businesses cannot support an organizational structure that includes a distinct CTO position. In a small business, the responsibilities of the CTO may be shared by another area of responsibility. Therefore, the targeted survey participant was the IT deployment decision-maker, which may be the CTO, chief information officer (CIO), chief executive officer (CEO), or technology leader equivalent. The study participants were expected to possess sufficient knowledge of the emerging cloud-computing technology to calibrate its perceived innovation attributes as stipulated in this study's Assumptions section.

The ACA cooperated in this study by inviting study participants. Using their e-mail contact information, ACA issued an e-mail announcement to small businesses for soliciting participation in this study. Additional specifications regarding the population and sampling process are stipulated in the Population and Sampling section.

Invited participants were presented information regarding the study's scope and purpose as well as opt-in access to the online survey instrument hosted at Survey Monkey. Disclosure was made to the participants regarding ethical information in compliance with the Walden University's Internal Review Board (IRB) requirements including participant anonymity surety. The researcher's contact information was provided to address any participant questions or concerns related to this study.

Beyond the benefit of helping to gain further knowledge related to the research topic, participants were offered the incentive to receive a copy of the study's findings. Optionally, e-mail information was collected at the conclusion of the online survey process to request a copy of the research results. The optionally entered e-mail information was maintained in a manner to ensure survey participant anonymity. At the outset of the survey, each participant was presented ethics and confidentiality information and was required to affirm participant consent prior to receiving authorization to engage in the survey. The ethics and confidentiality disclosure information that was presented online requiring participant affirmation prior to survey entry is featured in Appendix D.

Research Method and Design

A postpositivist worldview undergirded the premise of beliefs guiding the methodology and design of this inquiry. Based on a deterministic philosophy (Stacey, 2007), this doctoral study was undertaken to understand the relationship of small business leaders' perception of cloud-computing innovation attributes and their intent to adopt this emerging technology. The research method and design were logically derived from the study's applied business problem statement. The specific research methodology and design strategy stipulated for conducting this DBA study is described more fully in the following subsections.

Method

Creswell (2009) reported that postpositivism thinking challenged positivism, a prior traditional viewpoint about the absolute truth of knowledge. The postpositivist assumptions are steeped in deterministic philosophy that emphasizes examining relationships between items studied (Stacey, 2007). This vantage has been predominately used for quantitative research, commonly referred to as the scientific method or the empirical science. Empirical research has been classified as deductive reasoning, applying generalities to make inferences about the specifics. Deductive reasoning has been used as a lens for testing hypotheses derived from research questions (Génova, 2010; Stacey, 2007). Alternatively, qualitative methods have been recognized as more exploratory and inductive, formulating general rules based on particular cases (Creswell, 2009; Génova, 2010).

This inquiry was conceived in a postpositivist deterministic viewpoint by examining the relationship of small businesses' perception of cloud-computing innovation attributes and their intent to adopt the emerging cloud-computing technology. As such, a quantitative research method was elected for this research project. Endeavoring to verify as well as refute hypotheses, quantitative researchers accept only reasonable hypotheses possessing significant explanatory power (Génova, 2010). The study's hypotheses were empirically tested to address specific inferential research questions derived from the problem statement.

The purpose of the research was unfolded in clarity through the framing parameters of the research method elected (Creswell, 2009). Using the lens of Valier et al.'s (2008) theoretical model related to the adoption of IT during the prediffusion stage of an innovation, this quantitative study investigated the relationship between the independent study variables and the dependent variable. The quantitative analysis specified in this study employed SPSS's statistical functionality to perform descriptive and regression analysis computations based on the dependent variable, small business leaders' intention to use cloud-computing technology, and seven independent variables representing its perceived innovation attributes: compatibility, complexity, observability, relative advantage, results demonstrable, trialability, and voluntariness. The quantitative research method was ideally suited for deductively testing the study's objective theories by empirically measuring and statistically analyzing variables to understand construct relationships (Campbell & Stanley, 1963; Creswell, 2009; Génova, 2010; Onwuegbuzie et al., 2009; Stacey, 2007).

Offering an alternative approach to quantitative inquiry, qualitative research methods are typically framed in the embrace of social constructivism, interpretivism, critical theory, or advocacy and participatory philosophical perspectives while mixed methods research is adopted based on pragmatism as a worldview (Creswell, 2009; Onwuegbuzie et al., 2009). Qualitative research procedures are contextualized by formative and interpretive narrative inquiry, observation, and analysis activities. Qualitative research methods are generally exploratory in nature addressing open-ended questions inductively seeking to construe the meaning about a phenomenon derived from participants' vantage resulting in findings of particularity versus generalizability (Creswell, 2009; Yin, 2009). Qualitative case study research has been illustrated as an effective method for exploring postdictive DOI research to understand the influences attributed to the nature of social systems or the change agents (Rogers, 2003). Although distinct case themes are reflective of the particularity of the qualitative generalizations (Creswell, 2009), the rationale for the multiple case design is derived directly from the literal and theoretical replications from case to case, thus reporting the interpretive findings of comparative cases (Yin, 2009). The personal researcher time and effort intense qualitative exploratory methods typically are not as well suited as quantitative methods to predictive or deterministic focused inquiry outcomes.

Mixed methods research is recognized as a combination of the interdisciplinary strengths of deductive and inductive practices attributed to quantitative and qualitative epistemologies, respectively (Cassell et al., 2006). Mixed methods research has grown in popularity in social and human sciences studies (Creswell, 2009). The inherit characteristics of the qualitative aspect of a mixed methods approach were deemed to necessitate an expansion of the study's purpose statement and research problem. Although mixed methods research may have rendered applicability related to this inquiry, the scope of a mixed methods approach far exceeded the boundedness set forth by the research problem definition.

Research Design

Quantitative studies are acknowledged as offering fewer design approaches as compared to qualitative research methods. Creswell (2009) recognized the existence of a multitude of qualitative research approaches that he has distilled into the five distinct inquiry strategies of narrative, phenomenology, ethnography, case studies, and grounded theory. In contrast, quantitative research typically has been classified as either survey or experimental methods (Creswell, 2009). Campbell and Stanley (1963) featured 16 distinct experimental and quasi-experimental design models while Creswell featured two nonexperimental survey design strategies: cross-sectional and longitudinal.

While reiterating the importance of the rigor associated with the design of experiments, Campbell and Stanley (1963) recognized that ultimately every experiment was imperfect and fraught with potential sources of invalidity. Resembling other rigorous aspects of experimental design, the quasi-experimental design typically has lacked the element of random assignment and full control over scheduling of data collection (Campbell & Stanley, 1963; Trochim, 2006). The nonexperimental survey design was recognized as an alternative quantitative inquiry approach for examining trends, attitudes, or opinions via a sample of the subject population (Creswell, 2009). Claims or generalizations about the population typically are deduced based on the survey sample results.

Conceived in a survey design in which the study sample is derived from the entire sampling frame, this research was fashioned from a traditional quantitative cross-sectional survey design strategy that was not intended as an investigation of causation. Creswell (2009) described the quantitative cross-sectional survey design to include four elements: literature-based theoretical hypotheses and study variables, population sampling criteria, a single point data acquisition process via a survey instrument, and statistical data analysis and interpretation. The distinction between a cross-sectional and a longitudinal survey design strategy resides in the data collection process; whereby the longitudinal survey design strategy collects sample measurements at multiple points during an extended period (Creswell, 2009; Davidsen & Krogstie, 2010).

Bardhan (2007) and Davidsen and Krogstie (2010) illustrated the distinction between the cross-sectional and longitudinal survey research design strategies. Using a longitudinal survey research approach, Davidsen and Krogstie studied intrinsic problems and aspects related to information systems development and support by comparing survey results collected in 2008 with prior surveys conducted during a prior 15-year period. Conversely, Bardhan demonstrated the use of a quantitative cross-sectional survey design strategy. Based on a one-time survey of development product managers, Bardhan's research tested the development of adaptive structuation theory (AST) in relation to collaborative product commerce (CPC) practices associated with IT innovation.

Cloud computing was featured as a newly emerging IT innovation (Buyya et al., 2009; Etro, 2009; Katzan, 2010; Truong, 2010). The rationale for using a cross-sectional survey design approach was anchored in providing statistical inferences from measurement data collected at a specific point versus using multiple survey results collected during a longer period. Using the cross-sectional survey design achieved the predictive research problem requirement by measuring the participants' perceived innovation attributes in conjunction with their intent to use the innovation prior to or concurrent with adoption (i.e., prediffusion).

Quantitative survey data typically is collected via a self-administered survey or, alternatively, by conducting structured interviews with the participants (O'Hegarty et al., 2010). The structured interview procedure is often used when the researcher is seeking to collect other observable data in the process or when the self-administered surveys are not suitable for sample participants use (Creswell, 2009; O'Hegarty et al., 2010). The self-administered quantitative survey design approach was preferred over a structured interview strategy to more efficiently and cost effectively measure the requisite sample size in a timely manner (Bardhan, 2007; Creswell, 2009). Moreover, this cross-sectional research design entailed using a web-based self-administered data acquisition process hosted by the online survey provider Survey Monkey. Additional, information about the survey instrument, the survey administration, and the survey data retrieval have been more fully discussed in this study's Data Collection section.

Web-based survey tools have been used in numerous IT related surveys and offer benefits over traditional survey practices (Maronick, 2009; Oke et al., 2007; Valier et al., 2008). The use of a web-based survey tool is preferred due to responses being received more quickly than with traditional mail methods. Costs were calculated lower using the online survey tool because printing, mailing, and handling expenses were mitigated. The use of a web-based survey tool has benefited the participant by ensuring their anonymity while capturing necessary informed consent, eliminating manual response remittance activities, and assimilating with modern practices in electronic communication methods.

The population and sampling scope was an essential factor in informing this study research method and design. Originating from the study's problem statement, the theoretical population was described in the context of small businesses. The study population, which is the accessible population for collecting the study sample, was further honed by the purpose statement stipulating Arizona small businesses. Practical limitations in compiling an inclusive list of all Arizona small businesses precluded conducting simple random sampling of the study population in its entirety.

Narrowing the sample scope by the sampling frame of ACA's small business e-mail list provided viable access to derive an Arizona small business sample. A further narrowing of ACA's e-mail list via randomization was not elected because it was deemed potentially to yield an insufficient sample response. Therefore, a convenience sample based on the entire ACA small business e-mail list (Creswell, 2009) was used for this study. See the Population and Sampling section for more specific information about the population and sampling process performed.

Reciprocally, the research method and design strategy were shaped by and molded the study's data analysis process. Guided by the study's problem statement, the research design strategy became the mechanism used to narrow the viable data analysis processes suitable for formulating conclusions related to the study's research questions. The research design for this study stipulated quantitative analysis using SPSS's statistical functionality to perform bivariate regression and multivariate regression computations based on seven independent variables and one dependent variable. See the Data Analysis section following for more specific information about the data analysis process performed.

Population and Sampling

The population and sampling process was an essential aspect of this study's design strategy and for maintaining its integrity by ensuring internal and external validity. The study's scope and boundedness was framed by the population and sampling process. The role of the population and sample was discussed as a prelude to indentifying the study population and describing the specific sampling method employed. Last, the rationale and appropriateness of the elected sampling as well as the study participant's eligibility has been explained.

In quantitative research, statistical inference is a means of drawing conclusions about a population based on a subset of the population known as a sample (Anderson, Sweeny, & Williams, 2008; Creswell, 2009). The quality of the statistical inference is a function of the sampling method applied for collecting study measurements. Probability sampling is considered more generalizable for making population inferences than nonprobability sampling. A precise understanding of the population of interest and the sampling method employed was crucial for the study's design and the integrity of its findings.

Population

The population was described in a tiered context with the theoretical population at the highest level. The theoretical population typically represents the masses to which the study may be generalized (Trochim, 2006). The theoretical population has its origin in the study's overarching problem, which in this case was stipulated via the applied business problem statement as small businesses. The study population was defined by narrowing the theoretical population via the lens of the purpose statement to the domain of accessible subjects (Trochim, 2006). Representing the total subject domain of interest from which the sample was drawn, the study population consisted of Arizona small businesses. The sampling frame consists of the source means for gaining access to the study population to select a study sample (Anderson et al., 2008; Trochim, 2006). The sampling frame for this study was designated as ACA's small business e-mail list. A conceptualization of the population sampling is presented in Figure 5.

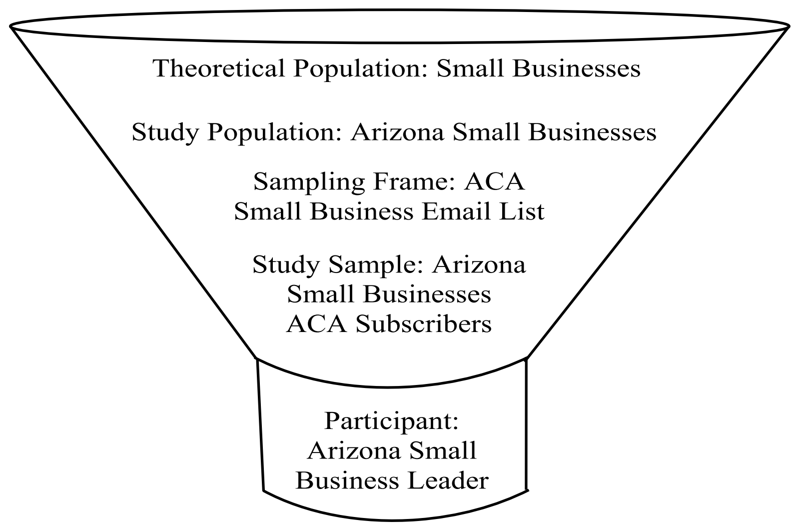

Figure 5. Conceptualization of the population sampling refinement process. The conceptual funnel was depicted illustrating the distillation of the theoretical population of small businesses into the purpose statement's study population of Arizona small businesses that were accessed via the sampling frame of ACA's small business e-mail list for soliciting participation in this study' survey to designate the study sample.

The U.S. Census Bureau (2008) reported that Arizona small businesses, which constituted this study's population, numbered at approximately 106,800 firms in 2008. An industry breakdown of the study population is depicted in Figure 6 to illustrate the diversity of the Arizona small business in 2008. However, the top four numbering sectors of the 19 industry sectors, including construction, professional together with scientific and technical, health care and social assistance, and retail trade, comprised slightly more than half of the total Arizona small businesses.

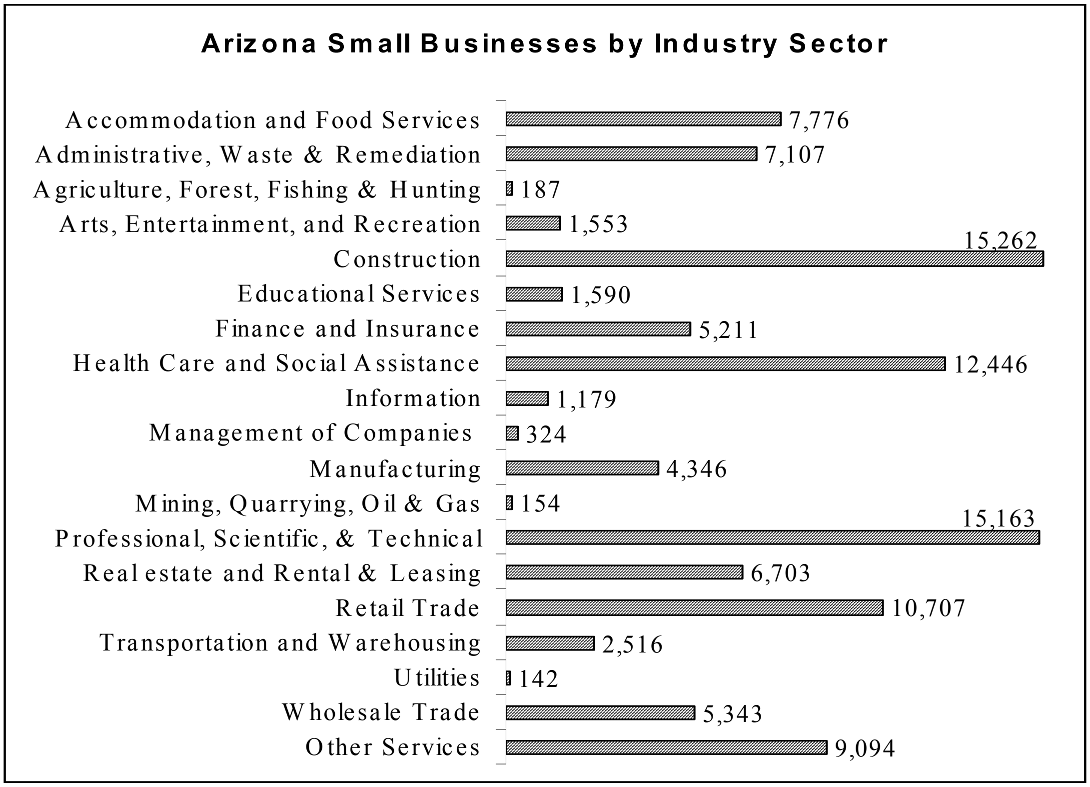

Figure 6. Bar chart of Arizona small businesses by industry sector. The number of firms within each industry sector was extracted from “Statistics of U.S. Businesses (SUSB): States, NAICS sectors,” published by U.S. Census Bureau in 2008.

The ACA was a newly established quasi-public state authority replacing the Arizona Department of Commerce governmental agency. The ACA’s purpose has been described as creating vibrant communities and a globally competitive Arizona economy via collaboration among private and public sectors to stimulate business startups, foster small business growth, and attract new businesses to the state (ACA, 2010). The ACA has maintained an e-mail list that it estimated to contain contact information for approximately 4,500 small businesses at the time of sampling frame election. ACA’s e-mail list represented a cross-section of Arizona firms from the various industry sectors and was used as the sampling frame for this study.

Sampling

Compiling a list of the entire population of Arizona small businesses was impracticable. In lieu of soliciting survey participation from the entire study population, Creswell (2009) recommended probability sampling by collecting survey measurements from a portion of the population for inference about the entire study population. Probability sampling consists of the rigor to ensure that the likelihood of being selected is known for each subject participant (Anderson et al., 2008). An alternative and less desirable method is nonprobability sampling, which consists of convenience, purposive, or judgment sampling.

In this instance, the sampling frame consisted of an ACA maintained e-mail list containing small business leaders' e-mail addresses. In response to opt-in and opt-out requests, ACA's e-mail list fluctuates. At the time of the survey announcement, 3,897 survey participation announcements were distributed by ACA using its e-mail list. A low response rate of roughly 3% was anticipated based on prior similar research results (Maronick, 2009; Oke et al., 2007). In lieu of inviting a randomized subset of the sample population, the entire ACA e-mail list was solicited for participation in the survey, ensuring a sufficient number of participants to derive meaningful results. Accordingly, a convenience sample method using the entire sampling frame was elected for this study. Macht and Robinson (2009) advocated convenience sampling with sufficient sample responses as opposed to insufficient sample responses from a random sample. Based on the sampled Arizona small businesses, the individual targeted as the survey participant was designated as the technology deployment decision-maker, which may be the CEO, CIO, CTO, or technology leader equivalent.

Rationale, Appropriateness, and Eligibility

Recapping the population and sampling frame, the targeted survey participant was the individual responsible for IT deployment decision-making within an Arizona small business. Qualified participants were invited to take part in the online study survey via e-mail announcements facilitated by ACA based on its small business e-mail listing. Constituents in the ACA e-mail list, typically, opt-in via e-mail contact (ACA, 2011). The ACA e-mail list was designated as the sampling frame for this study.

This study was crafted to rely on e-mail as the means for inviting participation in the online survey. Recent research (Maronick, 2009; Oke et al., 2007; Valier et al., 2008) demonstrated the viability of e-mail as a vehicle to solicit survey participation. Noted advantages of e-mail and Internet surveys included low cost, speed, and technology accepted modality while some disadvantages included low response rate concerns, questionable quality of expedited responses, and unsolicited e-mail filtering restricting access (Maronick, 2009). The concern related to the rejection of unsolicited e-mail filtering was mitigated as the ACA was designated as the sender via its e-mail list service and the opt-in recipients anticipated e-mails from ACA.

The study sample was initially estimated by ACA to contain of approximately 4,500 Arizona small businesses. This estimated study sample was expected to generate approximately 135 participants equating to a 3% response rate. The sample size was estimated due to fluctuations in ACA's e-mail list of Arizona small businesses. However, the actual sample size was 3,897, generating 151 completed surveys, which was slightly lower than a 4% response rate. The survey response rate was well above the required 117 number needed to achieve a medium effect size of 0.30, a significance level of .05, and a power of .90 as computed by the G*Power version 3.1.2 software program (Faul et al., 2009). The G*Power program was available free from the Internet via the universal resource locator (URL) address http://www.psycho.uni-duesseldorf.de/abteilungen/aap/gpower3/.

The study participants were expected to assess the innovation attributes related to the emerging cloud-computing technology. The CTO's responsibilities are uniquely aligned with the five variables associated with determining the rate of adoption of an innovation: perceived attributes of innovation, type of innovation-decision, communication channels, nature of social system, and change agent promotional effectiveness (Rogers, 2003). The CTO's uniquely aligned responsibilities were designated as the eligibility qualifications for candidates participating in this research survey. Not all small businesses could support an organizational structure that included a distinct CTO position. The responsibilities of the CTO may have been distributed to another area of responsibility. Therefore, the targeted survey participant was the IT deployment decision-maker, which may be the CTO or technology leader equivalent.

Ethical Research

Ethical research was a paramount concern for the researcher, Walden University, study participants, and others who rely upon the outcomes of this research. Ethical procedures and practices were undertaken ensuring that this research was conducted ethically. These ethical procedures included a participant consent and withdrawal process, disclosure of incentives, data safeguard practices, and compliance with Walden University's IRB guidelines.

An announcement disclosing the research purpose and soliciting study participation was issued via ACA using its e-mail publication distribution list. A copy of the Letter of Cooperation from the ACA was presented in Appendix E. Individuals electing to participate in the study linked to the survey hosted at Survey Monkey using the Internet URL provided in the ACA e-mailed invitation announcement.

As a prerequisite to the online survey, participants were issued information regarding the study's scope, purpose, participation qualifications, and ethics and confidentiality disclosure consent requirements. In compliance with the Walden University's IRB requirements, disclosure was made to the participant regarding ethical information including participant anonymity surety. The IRB approval number issued by Walden University for this research study was 07-07-11-0160136. Researcher contact information was provided for directly addressing any participant rights or privacy questions or concerns. Additionally, contact information to a Walden University representative was provided for other participant ethics concerns.

Participants were given the option to print a copy of the ethics and confidentiality disclosure. After reading the ethics and confidentiality disclosure, participants electing to proceed with the survey were required electronically to affirm agreement and consent prior to receiving access to the online survey instrument. Each participant was advised that at anytime throughout the survey process he or she may cancel the survey and withdraw his or her participation from the study. Moreover, if a participant considered any survey question too personal he or she was advised that he or she may elect to skip the question. After completing the survey, each participant was prompted optionally to provide, at his or her sole option, an e-mail address for receiving a copy of the completed study results.

The ethics and confidentiality disclosure statement was written stipulating that participant incentives were limited exclusively to the personal gratification of involvement in the study outcomes and the opportunity to receive, at the participant's sole discretion, a copy of the completed study results. No compensation or other inducements were offered for study participation. A copy of the Ethics and Confidentiality Disclosure Consent form is included in Appendix D.

Data collected through the online survey were maintained in a confidential and safe manner. No names of individuals or organizations or other identifying information were collected or stored with the survey data. Optional e-mail addresses entered requesting a copy of the study results were stored in a repository separate from the survey data and were used exclusively for that purpose. The survey data were collected to perform statistics functions as stipulated in the Data Analysis section. A copy of the study data was encrypted and maintained in a safe location for a minimum of 5-years to protect the rights of participants. A signed copy of the Researcher Confidentiality Agreement form is included in Appendix F.

Data Collection

The tools and the techniques crafted to acquire the prescribed data that was applied to the ensuing analysis for testing a priori hypotheses was the emphasis of the research data collection. The data acquisition tool is synonymous with the study survey instrument (Creswell, 2009). The data acquisition activities included the data collection and data organization techniques. Additionally, operational definitions for the quantitative study variables are presented as a prelude to the discussion of the instrument and data acquisition activities.

Operational Definitions of Variables

The relationship of small business leaders' perceived attributes of innovation relative to cloud computing and their intention to use the cloud computing encompasses the conceptualization of the constructs measured in this study. The construct perceived attributes of innovation comprised seven independent variables: relative advantage, compatibility, complexity, observability, trialability, results demonstrable, and voluntariness. The construct intent to use constituted the dependent variable. The elements used to assess each of these constructs were derived from prior research (Valier et al., 2008). The validity and reliability of these elements has been substantiated in prior peer reviewed research (Moore & Benbasat, 1991; Rogers, 2003; Valier et al., 2008). These variable elements provided a reliable and effective means for this study's data collection and measurement process. Each variable was operationalized by construct definition and element composition. Each item was measured using a 7-point Likert-type scale of ordinal values ranging from 1 to 7, with 1 = *strongly disagree*, 4 = *neutral*, and 7 = *strongly agree*.

Compatibility: Independent variable (X_1). Anchored in Rogers's (2003) compatibility construct assessing the perceived degree of congruence attributed to the innovation based on the adopter or potential adopter's experiences, values, and needs, Valier et al.'s (2008) operationalized definition was applied as the compatibility measurement for this DBA study. Ensuring construct reliability as well as appropriateness, Valier et al.'s compatibility measurement, adapting for cloud computing, comprised Items 1 through 4 as stipulated in the sample PreDOI survey instrument featured in Appendix A. Compatibility was an independent variable in the context of this study.

Complexity: Independent variable (X_2). Valier et al.'s (2008) complexity operationalization, which was based on Rogers's (2003) construct assessing the perceived degree of difficulty or simplicity attributed to understanding and using the innovation, was applied as the complexity measurement for this study. Ensuring construct reliability as well as appropriateness, Valier et al.'s complexity measurement, adapting for cloud computing, comprised Items 5 through 10 as stipulated in the sample PreDOI survey instrument featured in Appendix A. Complexity was an independent variable in the context of this study.

Intent to Use: Dependent variable (Y). Derived from Rogers's (2003) intent to use construct assessing the subject's propensity to adopt an innovation based on its prediffusion information, Valier et al.'s (2008) operationalized definition was applied as the intent to use measurement for this DBA study. Ensuring construct reliability as well as appropriateness, Valier et al.'s intent to use measurement, adapting for cloud computing, comprised Items 36 through 39 as stipulated in the sample PreDOI survey instrument featured in Appendix A. Intent to use was a dependent variable in the context of this study.

Observability: Independent variable (*X_3*). Valier et al.'s (2008) observability operationalization, which was derived from Rogers's (2003) construct assessing the perceived degree of visibility to others attributed to the results of the innovation, was applied as the observability measurement for this study. Ensuring construct reliability as well as appropriateness, Valier et al.'s observability measurement, adapting for cloud computing, comprised Items 11 through 14 as stipulated in the sample PreDOI survey instrument featured in Appendix A. Observability was an independent variable in the context of this study.

Relative advantage: Independent variable (*X_4*). Valier et al.'s (2008) relative advantage operationalization, which was based on Rogers's (2003) construct assessing the perceived degree of betterment attributed to an innovation in lieu of precursor ideas, was applied as the relative advantage measurement for this study. Ensuring construct reliability as well as appropriateness, Valier et al.'s relative advantage measurement, adapting for cloud computing, comprised of Items 15 through 22 as stipulated in the sample PreDOI survey instrument featured in Appendix A. Relative advantage was an independent variable in the context of this study.

Results demonstrable: Independent variable (*X_5*). Based on Moore and Benbasat's (1991) results demonstrable construct assessing the perceived degree to which tangible evidence of the benefits of an innovation is communicable, Valier et al.'s (2008) operationalized definition was applied as the results demonstrable measurement for this study. Ensuring construct reliability as well as appropriateness, Valier et al.'s results demonstrable measurement, adapting for cloud computing, comprised Items 23 through 26 as stipulated in the sample PreDOI survey instrument featured in Appendix A. Results demonstrable was an independent variable in the context of this study.

Trialability: Independent variable (*X_6*). Based on Rogers's (2003) trialability construct assessing the perceived ability for use inspection attributed to the innovation, Valier et al.'s (2008) operationalized definition was applied as the trialability measurement for this study. Ensuring construct reliability as well as appropriateness, Valier et al.'s trialability measurement, adapting for cloud computing, comprised Items 27 through 31 as stipulated in the sample PreDOI survey instrument featured in Appendix A. Trialability was an independent variable in the context of this study.

Voluntariness: Independent variable (*X_7*). Valier et al.'s (2008) voluntariness operationalization, which was based on Moore and Benbasat's (1991) construct assessing the perceived degree of self-determined sovereign choice to use an innovation, was applied as the voluntariness measurement for this study. Ensuring construct reliability as well as appropriateness, Valier et al.'s voluntariness measurement, adapting for cloud computing, comprised Items 32 through 35 as stipulated in the sample PreDOI survey instrument featured in Appendix A. Voluntariness was an independent variable in the context of this study.

Instrument

The discussion about the instrument was conducted to address its composition and integrity. The instrument source and the specific data collected were defined via the instrument composition. The instrument integrity was examined to reveal the instrument's reliability and validity.

Instrument composition. With the authors' permission as evidenced in Appendix G, the instrument used in the acquisition of the study data was adopted from Valier et al.'s (2008) PreDOI survey instrument. Change to the instrument was limited to replacing the reference of open source software to cloud computing throughout the PreDOI survey instrument leaving the remainder of the survey instrument unaltered. Regardless, cloud computing was conceived as having an evolutionary lineage of open source software; conceptually cloud computing has been viewed somewhat synonymous with open source software (Dwivedi & Mustafee, 2010; Sharif, 2010; Vescuso, 2010). In many facets of cloud computing such as IaaS and PaaS as well as with recent trends in SaaS, open source software was considered a primary enabler (Dwivedi & Mustafee, 2010).

Previously used for examining prediffusion adoption of IT innovations, Valier et al.'s (2008) PreDOI survey instrument was easily applicable to this study's data collection requirements. As with Valier et al.'s study, the PreDOI survey instrument employed in this study was administered via a hosted online web-based platform, which was Survey Monkey. Study participants were invited by e-mail and directed to an Internet URL link (www.surveymonkey.com/s/sepowelson) to contribute their survey input. A depiction of the PreDOI survey instrument highlighting the prompts for data item input was presented in Appendix A. The PreDOI survey instrument contained two main sections: general participant items and cloud computing research items.

The general participant information was derived in total from 16 selectable response items capturing nominal, ordinal, and interval measurements. The general participant information included three categories: participant demographics, social systems, and channel communications. The participant demographics information included Items A through E, which were constructed to capture the participant characteristics. The social systems information included Items F through K, which were configured to identify the context in which innovation was perceived. The channel communications included Items L through P, which facilitated recording the basic means of learning about the attributes of innovation.

The cloud computing research section of the PreDOI survey instrument was constructed to contain measurement scales related to the seven perceived attributes of innovation variables as well as the intent to use variable. These scales reflected the seven independent variables and the dependent variable, which were operationalized in the Operational Definition of Variables subsection. The cloud computing research section of the PreDOI survey instrument facilitated collecting data from 39 items based on a 7-point Likert-type scale of ordinal values for each item ranging from 1 meaning *strongly disagree* to 7 meaning *strongly agree*.

The constructs measured in this section of the instrument reflected the participant's perceptions about the attributes of cloud-computing innovation and their propensity to adopt cloud-computing technology. Recognizing that reversely worded items required inverting, the hypotheses were stated to suggest that the greater the score for the scale items compatibility, observability, trialability, relative advantage, results demonstrable and voluntariness ,the more favorable the participant perceives the innovation attribute while the lower the score for the scale item complexity, the more favorable the participant perceives the innovation attribute.

Instruments integrity. The online survey instrument was made available to Walden University's IRB for inspection and approval related to ethical compliance standards. The IRB ethical critique was essential for ensuring internal consistency via participant anonymity as well as assuring the potential for replicable external validity.

Valier et al. (2008) used their PreDOI survey instrument to measure participant perceptions related to open source software innovation attributes. Valier et al. tested the reliability and validity of the survey instrument and compared its results against similar primary diffusion studies. Valier et al.'s benchmarked results assessing their PreDOI instrument variables are presented in Table H1.

Psychometric theory has outlined the basis for quantitative assessment of the reliability and validity of abstract theoretical constructs or variables used to capture measurement items via survey instruments (Tiku & Pecht, 2010). Contrasting physical experimental research and empirical psychometric research, Tiku and Pecht (2010) featured an eight-step process for evaluating the survey instrument's internal consistency, which in psychometric terms means reliability, and its validity referring to the generalizability resultant from the measures functioning as intended.

Modeling empirical psychometric methods, Camisón and Forés (2010) developed novel measures of knowledge absorptive capacity constructs: potential and realized absorptive capacities. Camisón and Forés demonstrated the ability to measure knowledge absorptive capacity, an essential agent for innovation adoptions, via confirmatory factor analysis statistics related to the psychometric properties of reliability, validity, and dimensionality scales. The psychometric methods illustrated by Tiku and Pecht's (2010) and Camisón and Forés's (2010) quantitative research approach, which empirically validated their study measures, served as a template for the strategies crafted to address threats to this study's validity and reliability. Nevalainen, Larocque, Oja, and Pörsti (2010) further suggested extending univariate and multivariate nonparametric procedures ensuring clustered and hierarchical data for statistical legitimacy.

Based on the survey data collected, the survey instrument integrity was reexamined for reliability by performing the SPSS statistic functions Cronbach's coefficient alpha and factor analysis on item groups (Green & Salkind, 2008). A detailed review of reliability and validity confirmation procedures employed to substantiate the instrument has continued integrity was presented in the Data Analysis Techniques section. Comparing the confirmatory statistical results, which are depicted in Table H2, against Valier et al.'s (2008) instrument reliability and validity benchmarks featured in Table H1 served as a continued verification of this survey instrument's reliability and validity.

Data Collection Technique

The survey instrument was implemented as a self-administered online web-based survey hosted at Survey Monkey. Once implemented, the online survey instrument was visually inspected by an independent small panel to confirm that the instrument questions and parameters are matched to the original survey instrument questions and data collection stipulations. As a preface to the data collection activity, the online survey instrument was quality assurance tested to validate its functionality and accuracy in collecting the scale item responses. Afterwards, the online survey data repository was initialized to ensure that the test data were cleared prior to study participant entry.

Arizona small businesses included in the sampling frame were sent an e-mail soliciting their study participation in the online survey process. Participant invitees were informed about the study's scope, purpose, ethical consideration and consent requirements, and participation qualifications as well as opt-in access to the online survey instrument hosted at SurveyMonkey.com. In compliance with the Walden University's IRB standards, the ethical consensus, including participant anonymity surety, was affirmed as a prerequisite step in the online survey process.

The researcher's personal contact information was provided so that study questions, issues, and concerns may be addressed directly. The survey participants were presented the option to cancel the survey at any time during the process. Additionally, survey participants were offered the opportunity to skip any general participant information question that they preferred not to answer. At the end of the survey, participants were provided the opportunity to see their responses and edit them before final submission.

The self-administered online survey process conformed to the following general activities:

1. Affirmation of IRB consent form information.
2. Entry of the general participant survey information section data.
3. Entry of the Likert-type responses to each of the scale items contained in the survey instrument.
4. Optionally, review participant survey responses prior to final submission.
5. Entry of optional election to participate in the study incentives, which consisted of receiving a copy of the study results.

Data Organization Techniques

Daily throughout the online data collection process, the survey process was monitored for response levels and the entered survey data were archived for safeguard. The self-administered survey process was made available for a 10-day period. The survey participant, at his or her sole discretion, could have elected to receive the offered study incentives, which consisted of a complimentary report of the study results. The participant's incentive election information, which was an e-mail address, was stored in a repository separate from the survey data. The incentive election information was used to instruct individuals about retrieving a complimentary report of the published research results.

At the conclusion of the self-administered survey data collection period, the final survey dataset was downloaded from SurveyMonkey.com for archival and analysis. The final survey dataset was encrypted and copied to a permanent online archive and a write-once compact disk. Subsequently, the final survey dataset was transformed into an Excel workbook before importing into the windows-based SPSS program. Thereafter, the study's data were stored and processed in an SPSS native file format. Additionally, SPSS log files were maintained as an audit trail of the data transformations, computed variables, and other statistical manipulations. The SPSS datasets and process log files were added to the research data archives for safekeeping and research integrity.

Data Analysis Technique

Architecturally framed by the research strategy, the data analysis procedures and techniques were designed to test the study hypotheses that were fashioned from the research questions. Prior to hypotheses testing, the survey data were examined via descriptive statistics and analyzed for reliability and validity confirmation. The statistical analysis conducted for this research project was performed using SPSS's statistical procedures.

The software program SPSS was developed as a statistical analysis software package for the social sciences. The SPSS program was designed to automate the complex formulas and calculations used in various statistics allowing researchers to focus on the research analysis without having to master the arduous intricacies of the statistical functions (Green & Salkind, 2008). Prior research has been conducted using the SPSS program to calculate correlation coefficients to determine the relationships, if any, between independent and dependent variables (Green & Salkind, 2008; Ness, 2005). The SPSS Windows-based program PAWS Statistics GradPack© version 17.0.02 was employed to calculate the statistical results for this study based on the survey data collected.

Once the survey dataset was imported into the windows-based SPSS program as described in the Data Organization Techniques section, the study's data were maintained and stored in a SPSS native format throughout the analysis process. To facilitate study continuity, the variables and scale item responses were labeled consistently with naming references originating from this study's definitions and the PreDOI survey instrument. As discussed in the Descriptive Statistics Highlights section, incomplete survey instances were removed from the sample dataset as a preliminary step. Responses to items framed in a reversely worded manner were inverted into their respective reciprocal scale prior to statistical analysis ensuring consistency in item and scale interpretation. The scale items requiring reciprocal scale inversion included survey items 8, 9, 10, 13, 26, 32, 37, 38, and 39.

For each survey instance, a single value was computed for each of the eight variable constructs by calculating the mean value of the participant's responses corresponding to all items in the variable scale. The variable scale items were delineated in the Operational Definition of Variable sections. Based on the PreDOI theoretical framework applied to this research project, the computed variable values were subjected to statistical procedures using SPSS to examine the relationship of each of the seven independent variables and the one dependent variable. In addition to the hypothesis-testing procedures, this study's survey data were subjected to descriptive statistics and reliability and validity analysis. Collectively these analysis techniques were designed logically and sequentially to address the research questions.

Descriptive Statistics Techniques

Based on the 151 completed survey responses, univariate descriptive statistics were performed to concisely and precisely depict the variable and item measurement data by summarizing distributions of scores (Green & Salkind, 2008). Frequency distributions by number and percent were generated for the nominal and interval measures. The descriptive statistics for continuous scale measurement type data included count, minimum, maximum, mean, and standard deviation.

The initial aspect of the data analysis process involved performing univariate descriptive statistic procedures for the general participant information and the study measures composed of the independent and dependent variables. The descriptive statistics output related to the general participant information is presented in Appendix I. Based on the general participant information collected, frequencies and percentages were calculated and presented in a summary tabular format describing the participant characteristics, small business attributes relating to the social system conceptualization of DOI, and cloud-computing awareness relating to the communication channel conceptualization of DOI.

The independent and dependent study variable descriptive statistics included an analysis of the survey questions and the study variable scale constructs, which are presented in Appendix J. The study variables were based on the 39 cloud-computing research survey questions. For each cloud-computing research question, a Likert-type 7-point scale was used to indicate the participant's degree of disagreement or agreement. These indicator questions were subjected to descriptive statistical analysis to determine their central tendency and dispersion. A summary of the participant's responses to these questions is presented in Table J1. A scan of the initial descriptive statistics indicated that no responses to the cloud-computing research survey questions were missing from the sample of 151 participant surveys.

The cloud-computing research questions were examined for data extremes, which evidenced outliers that were recorded as responses to the instrument survey questions. Each cloud-computing research question was subjected to an exploratory analysis to examine the distribution of responses to the question. The computed study variables were formed as the basis for the analysis and relational hypotheses testing stipulated in this study. The study variables were subjected to descriptive statistical analysis to determine their central tendency, dispersion, and distribution. A summary of the study variables' central tendency and dispersion based on the completed survey dataset of 151 instances is presented in Table J2 and a summary of the study variables' distribution is presented in Table J3.

Testing for normality, a stem-and-leaf analysis accompanied by graphical boxplot depiction were applied to each computed variable construct to identify out-of-bound responses that may influence the analysis findings. The outcome of the initial normality assessment using the completed survey dataset is presented as a bloxplot diagram consisting of a summary of separate variables in Figure 7. An iterative process of normality testing was performed eliminating outliers for each variable, individually and collectively. The outcome of this process resulted in a normally distributed dataset such that each variable was normally distributed ignoring the other variable and each variable was normally at every level of the other variables.

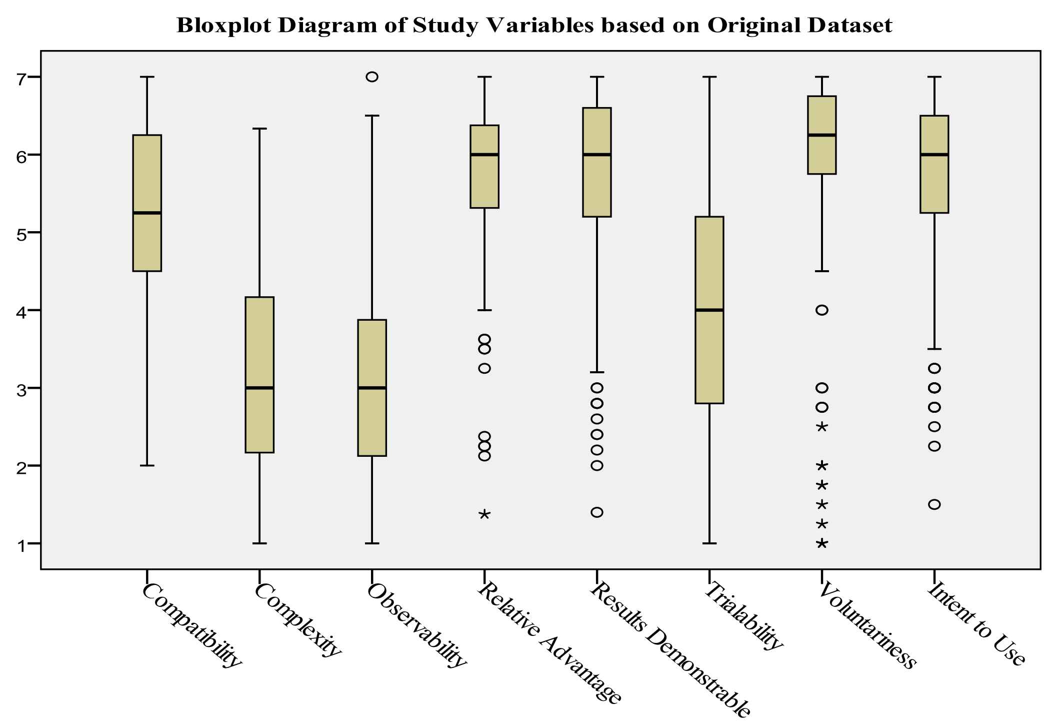

Figure 7. Completed survey dataset boxplot diagram comprising a summary of the separate study variables. For each study variable, a boxplot was depicted showing the quartile ranges with median item and item outliers, if any, based on the 151 completed survey responses.

The normally distributed dataset was expected to yield linear relationships between the independent variables and the dependent variable (Anderson et al., 2008). Using the normalized dataset as a basis, a summary of the study variables' central tendency and dispersion is presented in Table J4 and a summary of the study variables' distribution is presented in Table J5. A boxplot diagram consisting of a summary of separate variables based on the normalized dataset is presented in Figure 8.

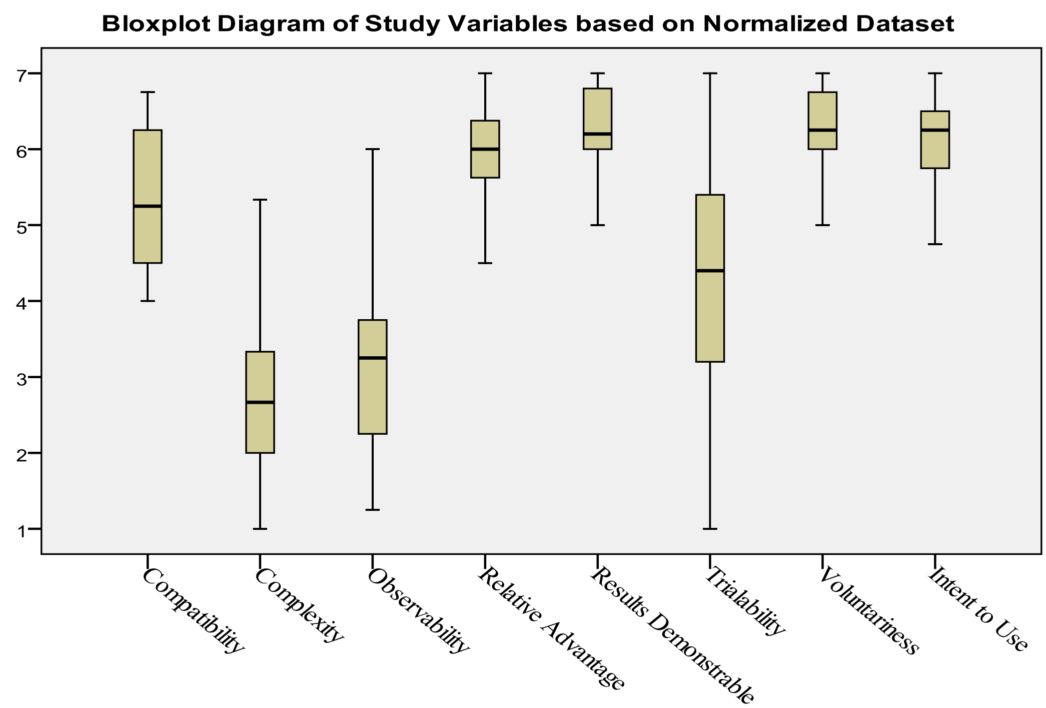

Figure 8. Normalized survey dataset boxplot diagram comprising a summary of the separate study variables. For each study variable, a boxplot was depicted showing the quartile ranges with median item for the 86 survey responses after eliminating outliers.

The number of survey response remaining in the normalized dataset was 86. The G*Power software program function "Post hoc: Compute achieved power" was performed for linear regression t tests that resulted in a power of .84 based on the sample size of 86, a medium effect size of 0.30, and a significance level of .05. The computed power was lower than the a priori calculated power of .90 anticipated in the study's design. The lower power result was considered a potential limitation related to the data analysis and study findings.

Reliability and Validity Analysis Techniques

Statistical procedures were performed to reaffirm the internal reliability of the survey instrument. The SPSS reliability analysis function was employed to confirm the instrument reliability via split-half estimates and Cronbach's coefficient alpha item analysis for each variable construct scale. Extending the split-half reliability procedure, Cronbach's coefficient alpha was utilized to assess the consistency of the scores among the items of a measurement construct by averaging all possible split-half combinations (Trochim, 2006). The actual item measurements were assessed without the need to convert the measurement data to z-scores as all item measurements were consistently defined by a 7-point Likert-type scale of ordinal values. Variable construct scale reliabilities ranged from .78 to .95 indicating that they exhibited an acceptable level of reliability. Although Cronbach's coefficient alpha ranges in value from 0 to 1, typically an Alpha equal to or greater than .7 is considered an acceptable level even though some authorities advocate for a stronger standard of at least .8 (Jiménez-Barrionuevo, García-Morales, & Molina, 2011; Wheeler, Vassar, Worley, & Barnes, 2011).

The SPSS factor analysis procedure was conducted to assess the measurement scales validity by performing a discrete analysis on each scale. An examination of eigenvalues was conducted to confirm that the scale items measured the construct tested. Based on the survey data collected, a summary of the instrument reliability and validity assessments is presented in Table H2. Consistency of the questions with PreDOI instrument was considered important to enable reliance on the reliability and validity significance results of previous studies as a basis for this study.

Hypotheses Testing Analysis Techniques

This research project was conceived in a nonexperimental quantitative design examining study variable relationships (correlations) that was not intended as an investigation of causation in contrast to more formal experimental methods investigating cause-and-effect. Eight hypotheses were set forth to address the study's research questions. The hypothesis tests were conducted using SPSS statistical analysis procedures based on the operationalized variables, which were calculated as the mean of the scale item values corresponding to the variable constructs. Based on the PreDOI theoretical framework applied to this research project, the Hypotheses H1 through H7 theorized relationships between each perceived cloud-computing attribute construct and intent to use cloud-computing technology while Hypothesis H8 theorized the distinction concerning the relationships between the attributes relative advantage and voluntariness with intent to use cloud-computing technology. The SPSS regression analysis output for each of the Hypotheses H1 through H8 is presented in Appendix K.

Analysis H1 to H7. For Hypotheses H1 through H7, separately each of the independent variables was examined assessing the extent of the relationship between small business leaders' perceived cloud-computing innovation attributes and their propensity for adoption. Bivariate regression tests were conducted to signal the degree of linear relations between each independent variable of cloud-computing attributes and the dependent variable intent to use based on the study sample. The bivariate linear regression equation related the predicted criterion ($\hat{Y}$) to each independent variable (X) via a slope weight (B_{slope}) for X and an additive constant ($B_{constant}$): $\hat{Y} = B_{slope} X + B_{constant}$ (Green & Salkind, 2008).

Whereas this research design was a nonexperimental quantitative cross-sectional study, the assumptions underlying the significance test were based on the random effects model. Green and Salkind (2008) ascribed the following assumptions underlying the significance test for the bivariate linear regressions:

1. The predictor and criterion variables are bivariately normally distributed in the population.
2. The scores on variables are independent of other scores on the same variables and are derived from a random sample.

The SPSS linear regression procedure was used to test significance by means of four correlation index variations: the Pearson correlation coefficient (r), the overall correlation index (R), a squared correlation (R^2), and an adjusted squared correlation (R^2adj). A correlation index equal to zero indicated no correlation between the predictor and the criterion variables. An index with a value below zero indicated an inverse or negative correlation while a value above zero indicated a positive predictive correlation. The closer the correlation index value approached either -1 or +1 the stronger the independent variable predicted the criterion variable (Anderson et al., 2008). The SPSS output for the bivariate linear regression included correlation coefficients and overall summary correlation statistics, which are presented in Table K1 and Table K2, respectively. Additionally, bivariate scatterplots were developed for each test depicting the occurrence of outliers as well as the existence of possible linear relationships.

Analysis H8. The eighth research question was an inquiry regarding which perceived attribute of innovation relative advantage or voluntariness has a stronger relationship to small business leaders' intent to use cloud-computing technology. Hypothesis H8 was specified to examine, during the prediffusion stage, whether small business leaders' perceived the relative advantage of cloud computing is more strongly related to their propensity to adopt the innovation than their perceived voluntariness of cloud computing. The multiple linear regression procedure was performed as a test for Hypothesis H8 to assess the strength-of-relationship index indicating the degree of correlation between the multiple predictor variables (i.e., the independent variables relative advantage and voluntariness) and the criterion variable, which in this case was the dependent variable intent to use. The multiple linear regression equation related the predicted criterion ($\hat{Y}$) to the linear combination of the independent variables and an additive constant. With two predictors (relative advantage and voluntariness) as stipulated in hypothesis H8, the regression equation is $\hat{Y} = B_{1slope} X_1 + B_{2slope} X_2 + B_{constant}$ (Green & Salkind, 2008).

The assumptions underlying the significance test based on the random effects model were applied. Green and Salkind (2008) ascribed the following assumptions underlying the significance test for the multiple correlation coefficients:

1. The variables are multivariately normally distributed in the population.

2. The cases represent a random sample from the population, and the scores on variables are independent of other scores on the same variables.

The SPSS multiple regression procedure was used to test significance by means of four correlation index variations: the Pearson correlation coefficient, the multiple correlation, a squared multiple correlation, and an adjusted squared multiple correlation (Green & Salkind, 2008). A multiple correlation index equal to zero indicated no correlations between the predictor and the criterion variables. A correlation coefficient with a value below zero indicated an inverse or negative correlation while a value above zero indicated a positive predictive correlation. The closer the correlation coefficient value approached either -1 or +1 the stronger the independent variable predicted the criterion variable (Anderson et al., 2008). The multiple regression analysis included part and partial correlations for each predictor and criterion, partialling out the effects of the other predictors in the regression equation. The SPSS output from the multiple linear regression procedures included coefficients and *t* test, regression correlations, and overall correlation indices with change statistics, which are presented in Table K3, Table K4, and Table K5, respectively.

Reliability and Validity

Reliability and validity considerations were integral to this study and were interwoven throughout, commencing with the initial study design and concluding with study findings and future implications. The reliability and validity issues were centric to the survey instrument as well as the overall study integrity. Although the meaning behind these terms varies depending on the research method, the quantitative definitions were applied for this study.

The survey instrument's reliability and validity were discussed in the Instrument Integrity subsection of the Data Collection section and in the Reliability and Validity Confirmation subsection of the Data Analysis Technique section. The following was provided as a recap of the survey instrument reliability and validity. The internal and external validity of the study was examined as well.

Reliability

In quantitative research, reliability has been defined as the assurance of the internal consistency in the instrument item measures as well as in the test administration and scoring (Creswell, 2009). The survey instrument used in this study was adopted from Valier et al.'s (2008) pretested PreDOI survey instrument. The basis for the reliability and validity of Valier et al.'s PreDOI instrument was demonstrated via statistic techniques including the factor analysis results presented in Table H1. The survey instrument was administered via an online web-based service.

Once setup, the survey instrument underwent visual inspections, including an independent small panel review, and quality assurance tests to validate that scores were accurately recorded. The nature of the online web-based survey data collection procedure was constructed to ensure reliability by mitigating the variability associated within in-personal survey administration. After collecting the study data, statistic techniques were performed as an initial phase of the data analysis procedures to ensure the instrument has continued reliability. As previously discussed in the Data Analysis

Technique section, the reliability statistical tests included Cronbach's coefficient alpha item analysis assessing internal consistency and factor analysis explaining the statistical variation and covariation among items.

Additionally, the research question hypotheses testing were conducted using SPSS's regression techniques as detailed in the Hypotheses Testing Analysis Techniques section. Testing Hypotheses H1 through H7, the bivariate linear regression procedure was applied as a means for examining the study variable relationships stipulated via the theoretical framework. Similarly, the multiple linear regression procedure was applied as the statistical function to test Hypothesis H8.

Validity

Validity in quantitative research has been defined as the assurance of concluding meaningful inferences from the instrument scores (Creswell, 2009). Threats to quantitative research validity have included internal issues, external factors, statistical conclusions, and construct adequacy. Participants with predisposition threaten internal validity. Internal validity consisted of assuring the veracity of the relationships between the independent variables and dependent variable while external validity consisted of ensuring the generalizability of the study variable relationships beyond the contexts of the study setting (Creswell, 2009; Onwuegbuzie et al., 2009).

The construct validity was ascertained by the adequacy of study variable definitions and measures whereas the statistical conclusion validity was confirmed by the accuracy of inferences drawn from the data based on statistical power and underlying assumptions (Creswell, 2009). Many of the threats associated with the experimental research design such as history, maturation, mortality, diffusion of treatment, interactions or selection, setting, or treatment, and other validity threats (Campbell & Stanley, 1963; Creswell, 2009) were not applicable to the nonexperimental cross-sectional survey design approach based on extant empirical psychometric research.

Regression and selection posed the greatest potential internal validity threats to this research. Creswell (2009) described regression validity issues as extreme participant scores and selection validity concerns as participants with predisposition to certain outcomes. Descriptive statistics and iterative or follow-up statistical functions as described in the Data Analysis Technique section were conducted to isolate or otherwise mitigate regression validity issues. The sampling approach was chosen as an optimal means for increasing the sample size for addressing potential selection validity concern based on the study population. Additionally, the SPSS factor analysis function, as previously discussed in the Data Analysis Technique section, was performed using the collected survey data to reaffirm the construct validity of the pretested PreDOI survey instrument.

The nature of the cross-sectional survey study mitigated several traditional experimental internal validity concerns (e.g., history, maturation, mortality, treatment diffusion, and control group demoralization or rivalry) because of the limited duration of participant involvement (Campbell & Stanley, 1963; Creswell, 2009). Independent expert review and critique of the statistical analysis techniques and procedures were engaged to elevate the study’s statistical conclusion validity. Correct inferences drawn from the study data to other settings in past or future situations substantiate quantitative research external validity (Creswell, 2009). This study's reliability and validity results were evaluated against Valier et al.'s (2008) results as well as other prior DOI research assessments.

Transition and Summary

The mechanics of the research study were revealed in the Project section by detailing the project's inner-workings and how the study was conducted including its underlying assumptions. The purpose for this quantitative survey study was to examine the relationship of small business leaders' perception of its cloud-computing innovation attributes and their propensity to adopt this emerging technology. The researcher's role was focused on ensuring the reliability and validity of the study while rendering the resultant findings.

The subject participants were defined as Arizona small business IT deployment decision-makers, which likely were CTOs or equivalent small business leaders. The sampling frame was designated as ACA's small business e-mail list. A convenience sample was drawn from the entire sampling frame to enhance the study sample size as a tradeoff to a random probability sample. The rationale for the quantitative research method was explained in context of the research problem and questions. Additionally, the suitability of the cross-sectional survey design using a self-administered, online web-based data collection tool was affirmed.

Valier et al.'s (2008) PreDOI survey instrument served as the research instrument, which was fully described featuring operational definition for the seven independent and one dependent measurement constructs. The procedures utilized to safeguard the data and preserve its integrity including encrypted permanent archives were disclosed. The reliability and validity of the instrument and overall study was affirmed via statistical techniques, research design practices, and other quality assurance methods.

The data was analyzed using SPSS statistical techniques to ensure comprehension of the data, reaffirm reliability and validity of the survey instruments, and to test the research question hypotheses. Bivariate linear regression tests were applied to test each of the Hypotheses H1 through H7. Similarly, multiple regression statistics were applied to test Hypothesis H8. The data analysis techniques were explained as a basis for supporting or disconfirming the stipulated hypotheses.

The interpretation of the data analysis and the study findings, including the research question conclusions, are presented and related to application for professional practice in Section 3. The study findings and conclusions are bound by the evidence collected in context of the theoretical framework. Grounded in the significance of the study foundation and project outcomes, implications for social change are expressed in terms of tangible improvements for workforce preparedness, environmental consciousness, and social entrepreneur enablement. A call to action is derived from the application of the study conclusions to professional practice and the recommendations for further study. Section 3 is closed by disclosing reflective insights related to the research project and the summary conclusions and by encouraging future improvement and benefit.

Section 3: Application to Professional Practice and Implications for Change

The purpose of this quantitative survey inquiry was to examine the relationship between small business leaders' perception of cloud-computing innovation attributes and their propensity to adopt the emerging cloud-computing technology. The previous sections of this study were composed to establish the foundation and project workings for a doctoral study with practical applications. Supported by a review of the professional and academic literature, the Section 1 foundation included a statement of the problem researched, a description of the research purpose, a summary of the nature of the study, the research questions and associated hypotheses, and the theoretical framework basis as well as an emphasis about the study's significance. Section 2 included a discussion of the project workings that incorporated an understanding about the role of the researcher, the participants, the mechanics of research method and design, the population and sampling approach, data collection technique and data organization practice, and the data analysis techniques as well as an assessment of the study's reliability and validity.

Building on the research foundation and project mechanics, Section 3 contains the research results and its significance. Following an overview of the research study, the researcher presents the study findings in context of the theoretical framework and research questions, discusses how the research can be applied to professional practice and its underpinning implications for social change, and provides recommendations for action and further study. In closing, the researcher shares reflections about the study and presents a recap of the study and the research conclusions.

Overview of Study

Although the general problem targeted by this study was the slow embrace of technology innovations by small businesses, the specific problem researched was honed to small business early adoption of cloud-computing innovation for improved economic value. The research project's purpose was founded on a review of the professional and academic literature emphasizing five topical areas: small business trends and economic contributions, small business innovation policy, the strategic role of small business innovation, small business IT and Internet innovation practices, and the emerging cloud-computing ecosystems. Based on this foundation, the purpose for this inquiry was to examine the relationship between small business leaders' perceptions of cloud-computing attributes and their propensity to adopt the emerging cloud-computing technology.

The theoretical framework for this study was adopted from Valier et al.'s (2008) predictive DOI theory, which predominantly was grounded in Rogers (2003) and Moore and Benbasat's (1991) DOI research. The predictive DOI framework was embraced to assess small business leaders' intent to use emerging cloud-computing technology and their perceptions about cloud-computing innovation attributes relying on the variable constructs relative advantage, compatibility, complexity, observability, trialability, results demonstrable, and voluntariness. Following this theoretical framework, this research project was constructed based on a quantitative research method using a nonexperimental cross-sectional survey design strategy.

In response to the problem statement and the study purpose, given small business volatility and economic importance, the overarching research question guiding this study was, “What is the propensity of small businesses to embrace the cloud computing novel business-computing paradigm?” Anchored in the predictive DOI theoretical framework, the seven perceived attributes of innovation were designated as independent (predictor) variables and intent to use was designated as a dependent (criterion) variable. For each of the seven perceived attributes of cloud-computing innovation, a research question and corresponding hypothesis was stipulated to examine individually the extent of the relationship between small business leaders’ perceived attribute of innovation and their intent to use cloud computing. The eighth research question and corresponding hypothesis was stipulated to examine the strength of relationship between relative advantage and intent to use in comparison to the strength of relationship between voluntariness and intent to use.

Valier et al.’s (2008) previously tested online survey instrument, which was designed to assess the adoption of IT during the prediffusion stage of an innovation, was applied to collect the data for this study. The study’s survey instrument included 16 questions related to the participant and 39 questions related to small business leaders’ perceived cloud-computing innovation attributes and their intent to use cloud-computing technology. The survey instrument was implemented as a self-administered online survey hosted at Survey Monkey.

The research survey was announced via an Arizona Commerce Authority e-mail distribution soliciting participation from senior IT deployment decision-makers based on a convenience sample of small businesses drawn from an entire e-mail list maintained by ACA. The survey participant’s involvement included affirmation of IRB consent, entry of general participant information, entry of the Likert-type responses to each scale item question, and optional designation of the election to receive a copy of the study results. At the conclusion of the data collection timeframe, the study's data were retrieved, encrypted and archived, and imported into SPSS for statistical analysis to test the stipulated hypotheses.

The data analysis procedures and techniques performed were architecturally framed by the study's quantitative research method and cross-sectional survey design approach. The software program SPSS was used to calculate the statistical results based on the survey data collected. The current study's analytical scope included descriptive statistics, instrument reliability and validity confirmation, and hypotheses-testing correlation regressions.

The 3,897 e-mails distributed by the ACA announcing the research survey resulted in 151 completed surveys equaling a 3.87% response rate. Univariate descriptive statistics were performed using the survey data to depict the central tendency, dispersion, and distribution of the participant information, item measurements, and variable data. Based on the participant information collected via the survey instrument, frequencies and percentages were calculated and presented in a summary tabular format describing the participant characteristics, small business attributes, and cloud-computing awareness.

Each cloud-computing research question, which used a Likert-type 7-point scale to indicate the participant's degree of disagreement or agreement, was subjected to descriptive statistical analysis to determine its central tendency and dispersion. Similarly, the study variables, which were calculated based on the mean of the corresponding item scale values for each instance, were subjected to descriptive statistical analysis to determine their central tendency, dispersion, and distribution. For each of these analysis procedures, summary statistics were reported in tabular format while key statistics are highlighted in the Descriptive Statistics Findings section.

Additionally, statistical procedures were performed to reaffirm the internal reliability of the survey instrument. The SPSS reliability analysis function was employed to confirm the instrument reliability using Cronbach's coefficient alpha item analysis for each variable construct scale. The SPSS factor analysis procedure was conducted to assess the measurement scales validity by performing a discrete analysis on each scale. An examination of eigenvalues was conducted to confirm that the scale items measured the construct tested.

Analysis was performed to test the research hypotheses by using SPSS statistical procedures to examine the relationship of each of the seven independent variables and the one dependent variable. As a basis for the hypotheses testing, normality test procedures were performed to ensure that the hypotheses-testing dataset was normally distributed. For each hypothesis, statistical procedures were performed assessing the extent of the relationship, individually, between each perceived cloud-computing innovation attribute and intent to use cloud computing. The bivariate regression statistics procedures were applied separately to each of the independent variables and the dependent variable testing Hypotheses H1 through H7. The bivariate SPSS regression analysis procedures were performed to assess the degree of relationship, if any, based on each predictor variable and the criterion intent to use. The multiple regression statistics procedures were applied to test Hypothesis H8, which assessed the strength of relationship between relative advantage and intent to use in comparison to the strength of relationship between voluntariness and intent to use.

The basis for the study findings was framed in the interpretation of the results of the data analysis procedures. With the exception of Hypothesis H7, the null hypothesis associated with each research question was rejected; therefore, the findings were interpreted as supporting the hypothesized predictions for each research question other than the seventh research question. Statistical diagrams are presented that further supported findings from this study. A further discussion of the data analysis interpretation and study findings is presented in the Presentation of the Findings section.

Presentation of the Findings

This study's findings were organized by presenting conclusions addressing each research question. These conclusions were derived from the interpretation of the outcomes of the data analysis performed based on the survey data collected as described in Section 2. To address the research questions, hypothesis-testing regression statistics procedures were applied separately to the stipulated predictor variables and the criterion variable intent to use. The variable construct intent to use was operationally defined as the subject's propensity to adopt cloud-computing technology. An operational definition for each predictor variable is restated in the discussion of the corresponding research question findings.

For Hypotheses H1 through H7, bivariate regression analysis procedures were performed as a test to determine the degree of relationship between each predictor variable and the criterion intent to use. For Hypothesis H8, the multiple linear regression procedure was performed as a test to assess the strength-of-relationship index indicating the degree of correlation between the multiple predictor variables relative advantage and voluntariness and the criterion variable intent to use. Reinforcing the conclusions, the study findings were related to the theoretical framework and the extant literature regarding effective business practices.

Derived from the completed survey dataset, a scatterplot overlay mapping the variable coordinate relationships between each cloud-computing attribute and intent to use is presented in Figure 9. Although this overlay diagram does not depict any strong relationships, the scatterplot overlay was provided as a basis for graphically comparing the predictor and criterion variable relationships based on the completed survey dataset with the individual scatterplot diagrams based on the normalized dataset presented for each research question findings.

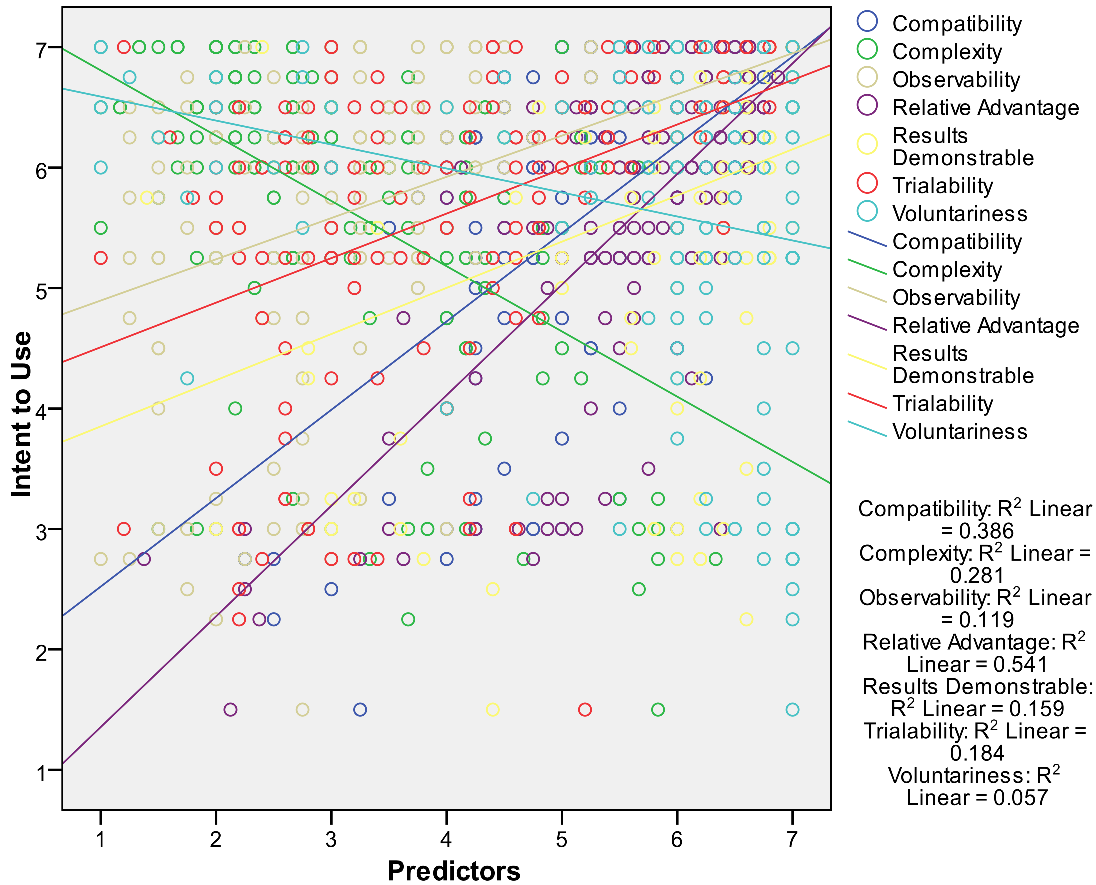

Figure 9. Scatterplot overlay mapping the predictor and criterion coordinate relationships. For each sample response based on the completed dataset of 151 surveys, best-fit lines were formed to depict the linear relationships between each predictor variable and the criterion variable intent to use including R^2 coefficients for each correlation.

Descriptive statistics highlights were presented as a preface to the hypothesis-testing findings to instill greater understanding about the study participants and the research data collected. Univariate descriptive statistics procedures were applied to the general participant information collected via this study's survey. The resultant key descriptive statistics included participant characteristics, small business attributes, and cloud-computing awareness. Additionally, descriptive statistics related to the study variables based on the completed survey and normalized datasets were highlighted.

Descriptive Statistics Highlights

As the initial phase of the data collection process, ACA distributed 3,897 e-mails announcing this study to solicit survey participation. The e-mail announcement precipitated 154 survey participants. Three of the survey participants elected to cancel the survey process resulting in 151 completed surveys equaling a 3.87% response rate, which exceeded the initial response projection calculations. Based on the completed survey responses, descriptive statistics highlights are presented about the participant characteristics, small business attributes, and cloud-computing awareness. Descriptive statistics highlights are presented about the study variables based on the normalized dataset that resulted from a refinement of the completed survey responses after eliminating variable outliers.

Participant characteristics. The descriptive statistics composing the participant characteristics, which were framed on Survey Questions A through E, are presented in Table I1. Eighty respondents, equaling 53% of the sample, indicated that the responsibility classification of information technology best fit them, while 37 respondents, representing 24.5% of the sample, designated the executive classification. The ages 41-50 years and 31-40 years nearly tied for the top age-range category rankings with 55 participants equaling 36.7%, and 49 participants equaling 32.7% of the respondents, respectively. Although 11 participants constituting 7.3% of the sample elected not to specify a gender designation, 106 participants equaling 75.7% of the respondents designated male as their gender. Ninety-eight participants representing 65.3% of the respondents designated the education level classification of a Bachelor's degree. The 11-20 years category was designated most for the number of years of fulltime experience with 73 responses equaling 48.3% of the sample.

Small business attributes. The descriptive statistics composing the business attributes, which were based on Survey Questions F through K, are presented in Table I2. Seventy-one participants equaling 47.3% of the respondents designated the classification corporation as their firm's legal structure while 62 participants representing 41.6% of the respondents designated the category 11-20 years as the range of years that their firm had been in business. Although the number of industry categories in which the participants' firms operated was broad, the top three designated categories garnered more than half of the total responses. Totaling more than half of the industry classifications, professional, science, and technical, finance and insurance, and education were designated by 38 participants equaling 25.5%, 25 participants equaling 16.8%, and 22 participants equaling 14.8% of the respondents, respectively. As a measure of firm size based on the sample, 82 participants equaling 54.3% designated 10-49 employees as the range for the firm's number of employees while 87 respondents representing 57.6% selected the classification of less than $2 million for the firm's annual revenue category. Although 124 participants representing 82.7% of the respondents indicated that their firm did not use cloud-computing technology, 26 participants designated that their firm used at least one cloud-computing technology. Eighteen of the 26 respondents indicated that their firm used cloud-computing designated hosted application such as e-mail, office, or other utility functions as the nature of their firm's cloud computing usage.

Cloud computing awareness. The descriptive statistics composing the cloud computing awareness, which were derived from Survey Questions L through P, are presented in Table I3. Eighty-three participants equaling 55.7% of the respondents designated 1-3 years as the range of years in which the participant had known about cloud computing. Although four individuals elected not to respond to Question M, 112 participants equaling 76.2% of the respondents designated not attending any cloud computing presentation. Conversely, 124 participants equaling 82.1% of the sample indicated having read advertisements about cloud computing. One hundred nine participants representing 72.7% of the respondents indicated that they had talked with a colleague about cloud computing. Last, 117 participants equaling 79.1% of the respondents indicated not having previously used cloud computing.

Study variable measures. The refinement of the completed survey responses based on the normalized study variables restricted the dataset to 86 survey instances. This normalized dataset was the basis for the study variable descriptive statistics and the hypothesis-testing regression statistics. Based on the mean study variables, generalizations about the sample of perceived attributes of cloud-computing technology and intent to use cloud-computing technology were developed. On average, participants indicated that they somewhat less than slightly disagreed that cloud computing was difficult to understanding and use while indicating that they somewhat more than slightly disagreed that its results were visible to others. Participants, on average, indicated slightly more than neither disagreement nor agreement that they possessed the ability for use inspection of cloud computing. On average, participants indicated that they nearly agreed (i.e., more than slightly agreed but less than agreed) that cloud computing was perceived a betterment in lieu of precursor ideas and cloud computing was congruent with their experiences, values, and needs. On average, participants indicated that they more than agreed that the tangible evidence of its benefits were communicable, using cloud computing was a self-determined sovereign choice, and they intended to use cloud-computing technology.

Research Question 1 Findings

The first research question asked: To what extent does relative advantage, a perceived attribute of innovation, relate to small business leaders' intent to use cloud-computing services? The variable construct relative advantage was operationally defined as the perceived degree of betterment attributed to cloud-computing technology in lieu of precursor ideas. Based on a review of the literature related to the cloud-computing ecosystem and the theoretical framework, the first hypothesis was framed theorizing that, during the prediffusion stage, the higher the level small business leaders perceived the relative advantage of cloud computing the greater their propensity to adopt the innovation. The null hypothesis $H1_0$ was stipulated: No correlation exists between relative advantage and intent to use cloud computing.

A linear regression analysis was performed to evaluate the prediction of intent to use cloud-computing technology based on small business leaders' perceived relative advantage of cloud-computing innovation. The scatterplot diagram depicting relative advantage and intent to use, as shown in Figure 10, was presented revealing that the two variables were linearly related such that as the attribute relative advantage increased the intent to use increased. The regression equation for predicting the intent to use, given relative advantage, was

$$\textit{Predicted Intent to Use} = .49\ \textit{Relative Advantage} + 3.25. \qquad (1)$$

An intent to use value of 3.25, which reflected the regression equation y-intercept value when relative advantage theoretically equaled zero, was interpreted as a propensity to use cloud-computing technology between *slightly disagree* and *neither disagree or agree*. The 95% confidence interval for the slope, .26 to .71, did not contain the value zero, and therefore relative advantage was significantly related to intent to use.

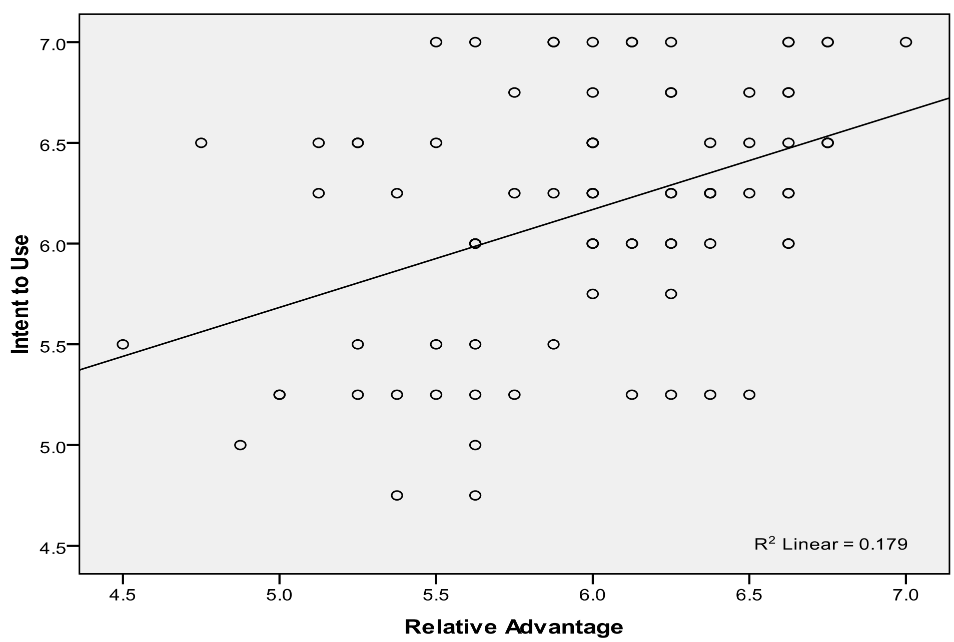

Figure 10. Scatterplot mapping relative advantage and intent to use coordinates. The coordinates, best-fit line, and R^2 coefficient were based on the normalized dataset.

The significance tests for the bivariate regression analysis included the *t* test associated with the SPSS coefficients table output. The bivariate linear regression test result was significant, $t(84) = 4.28$, $p < .01$. The magnitude of the standardized correlation coefficient was between medium and large, .42, evidencing that relative advantage was more than moderately related to intent to use. Approximately 18% of the variance of the intent to use was associated with relative advantage. As hypothesized, the $H1_0$ null hypothesis was rejected ($p < .01$), and relative advantage was deemed positively correlated to intent to use. Therefore, based on these findings the first hypothesis, H1, was supported. The conclusion related to the first research question was interpreted based on the statistical analysis findings indicating that relative advantage was correlated to intent to use in a greater than moderate positive degree.

Research Question 2 Findings

The second research question asked: To what extent does compatibility, a perceived attribute of innovation, relate to small business leaders' intent to use cloud-computing services? The variable construct compatibility was operationally defined as the perceived degree of congruence attributed to cloud-computing technology based on the subject's experiences, values, and needs. Guided by a review of the literature related to the cloud-computing ecosystem and the theoretical framework, the second hypothesis was framed theorizing that, during the prediffusion stage, the higher the level small business leaders perceived the compatibility of cloud computing with extant factors the greater their propensity to adopt the innovation. The null hypothesis $H2_0$ was stipulated: No correlation exists between compatibility and intent to use cloud computing.

A linear regression analysis was performed to evaluate the prediction of intent to use cloud-computing technology based on small business leaders' perceived compatibility of cloud-computing innovation. The scatterplot diagram depicting compatibility and intent to use, as shown in Figure 11, was presented revealing that the two variables were linearly related such that as the attribute compatibility increased the intent to use increased. The regression equation for predicting the intent to use, given compatibility, was

$$\textit{Predicted Intent to Use} = .28\ \textit{Compatibility} + 4.63. \quad (2)$$

An intent to use value of 4.63, which reflected the regression equation y-intercept value when compatibility theoretically equaled zero, was interpreted as a propensity to use cloud-computing technology between *neither disagree or agree* and *agree slightly*. The 95% confidence interval for the slope, .14 to .42, did not contain the value zero, and therefore compatibility was significantly related to intent to use.

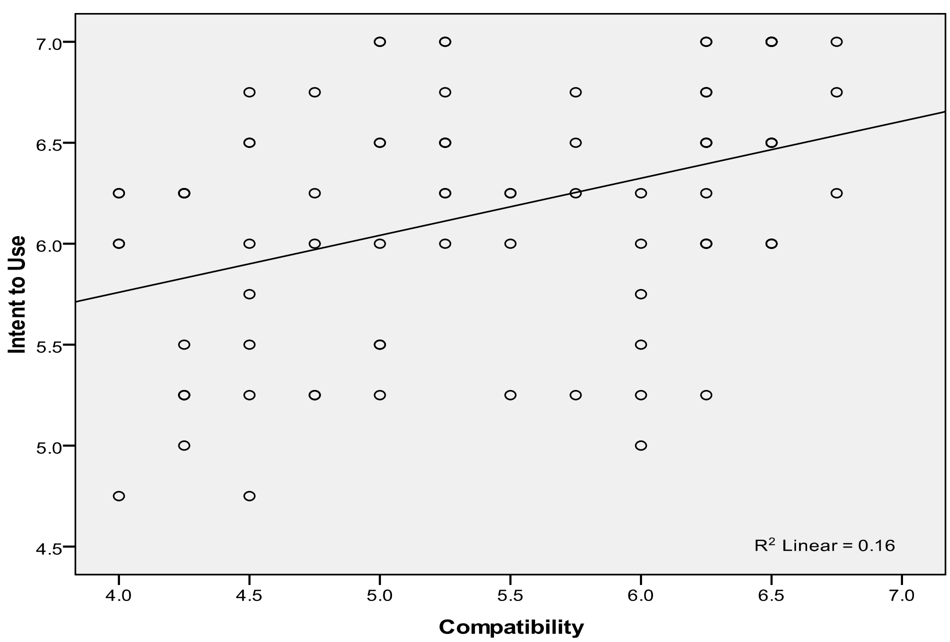

Figure 11. Scatterplot mapping compatibility and intent to use coordinates. The coordinates, best-fit line, and R^2 coefficient were based on the normalized dataset.

The significance tests for the bivariate regression analysis included the *t* test associated with the SPSS coefficients table output. The bivariate linear regression test result was significant, $t(84) = 4.00$, $p < .01$. The magnitude of the standardized correlation coefficient was between medium and large, .40, evidencing that compatibility was more than moderately related to intent to use. Approximately 16% of the variance of the intent to use was associated with compatibility. As hypothesized, the $H2_0$ null hypothesis was rejected ($p < .01$), and compatibility was deemed positively correlated to intent to use. Therefore, based on these findings the second hypothesis, H2, was supported. The conclusion related to the second research question was interpreted based on the statistical analysis findings indicating that compatibility was correlated to intent to use in a greater than moderate positive degree.

Research Question 3 Findings

The third research question asked: To what extent does complexity, a perceived attribute of innovation, relate to small business leaders' intent to use cloud-computing services? The variable construct complexity was operationally defined as the perceived degree of difficulty or simplicity attributed to understanding and using cloud-computing technology. Guided by a review of the literature related to the cloud-computing ecosystem and the theoretical framework, the third hypothesis was framed theorizing that, during the prediffusion stage, the lower the level small business leaders perceived the complexity of cloud computing the greater their propensity to adopt the innovation. The null hypothesis $H3_0$ was stipulated: No correlation exists between complexity and intent to use cloud computing.

A linear regression analysis was performed to evaluate the prediction of intent to use cloud-computing technology based on small business leaders' perceived complexity of cloud-computing innovation. The scatterplot diagram depicting complexity and intent to use, as shown in Figure 12, was presented revealing that the two variables were linearly related such that as the attribute complexity increased the intent to use decreased and inversely as the complexity attribute decreased the intent to use increased. The regression equation for predicting the intent to use, given complexity, was

$$\textit{Predicted Intent to Use} = -.25\ \textit{Complexity} + 6.86. \qquad (3)$$

An intent to use value of 6.86, which reflected the regression equation y-intercept value when complexity theoretically equaled zero, was interpreted as a propensity to use cloud-computing technology between *agree* and *strongly agree*. The 95% confidence interval for the slope, -.38 to -.13, did not contain the value zero, and therefore complexity was significantly related to intent to use.

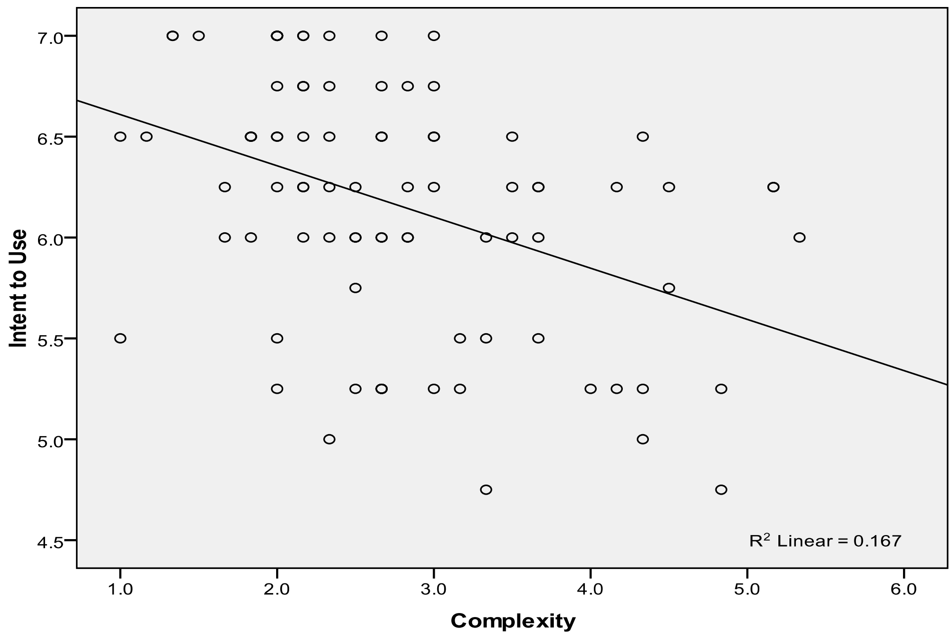

Figure 12. Scatterplot mapping complexity and intent to use coordinates. The coordinates, best-fit line, and R^2 coefficient were based on the normalized dataset.

The significance tests for the bivariate regression analysis included the *t* test associated with the SPSS coefficients table output. The bivariate linear regression test result was significant, $t(84) = -4.11$, $p < .01$. The magnitude of the standardized correlation coefficient was between medium and large, -.41, evidencing that complexity was more than moderately related to intent to use. Approximately 17% of the variance of the intent to use was associated with complexity. As hypothesized, the $H3_0$ null hypothesis was rejected ($p < .01$), and complexity was negatively correlated to intent to use. Therefore, based on these findings the third hypothesis, H3, was supported. The conclusion related to the third research question was interpreted based on the statistical analysis findings indicating that complexity was correlated to intent to use in a greater than moderate inverse degree.

Research Question 4 Findings

The fourth research question asked: To what extent does observability, a perceived attribute of innovation, relate to small business leaders' intent to use cloud-computing services? The variable construct observability was operationally defined as the perceived degree of visibility to others attributed to the results of the cloud-computing technology. Guided by a review of the literature related to the cloud-computing ecosystem and the theoretical framework, the fourth hypothesis was framed theorizing that, during the prediffusion stage, the higher the level small business leaders perceived the observability of cloud computing the greater their propensity to adopt the innovation. The null hypothesis $H4_0$ was stipulated: No correlation exists between observability and intent to use cloud computing.

A linear regression analysis was performed to evaluate the prediction of intent to use cloud-computing technology based on small business leaders' perceived observability of cloud-computing innovation. The scatterplot diagram depicting observability and intent to use, as shown in Figure 13, was presented revealing that the two variables were linearly related such that as the attribute observability increased the intent to use increased. The regression equation for predicting the intent to use, given observability, was

$$\textit{Predicted Intent to Use} = .11\ \textit{Observability} + 5.83. \tag{4}$$

An intent to use value of 5.83, which reflected the regression equation y-intercept value when observability theoretically equaled zero, was interpreted as a propensity to use cloud-computing technology nearing *agree*. The 95% confidence interval for the slope, .02 to .23, did not contain the value zero, and therefore observability was significantly related to intent to use.

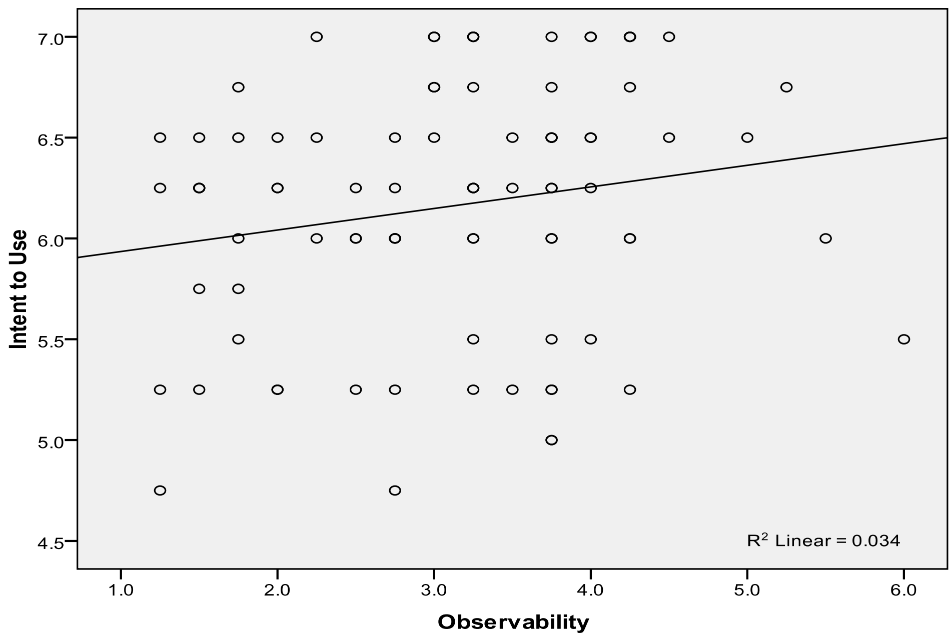

Figure 13. Scatterplot mapping observability and intent to use coordinates. The coordinates, best-fit line, and R^2 coefficient were based on the normalized dataset.

The significance tests for the bivariate regression analysis included the *t* test associated with the SPSS coefficients table output. The bivariate linear regression test result was significant, $t(84) = 1.72$, $p < .01$. The magnitude of the standardized correlation coefficient was between small and medium, .19, evidencing that observability was less than moderately related to intent to use. Approximately 3% of the variance of the intent to use was associated with observability. As hypothesized, the $H4_0$ null hypothesis was rejected ($p < .01$), and observability was positively correlated to intent to use. Therefore, based on these findings the fourth hypothesis, H4, was supported. The conclusion related to the fourth research question was interpreted based on the statistical analysis findings indicating that observability was correlated to intent to use in a slightly moderate positive degree.

Research Question 5 Findings

The fifth research question asked: To what extent does trialability, a perceived attribute of innovation, relate to small business leaders' intent to use cloud-computing services? The variable construct trialability was operationally defined as the perceived ability for use inspection attributed to cloud-computing technology. Guided by a review of the literature related to the cloud-computing ecosystem and the theoretical framework, the fifth hypothesis was framed theorizing that, during the prediffusion stage, the higher the level small business leaders perceived the trialability of cloud computing the greater their propensity to adopt the innovation. The null hypothesis $H5_0$ was stipulated: No correlation exists between trialability and intent to use cloud computing.

A linear regression analysis was performed to evaluate the prediction of intent to use cloud-computing technology based on small business leaders' perceived trialability of cloud-computing innovation. The scatterplot diagram depicting trialability and intent to use, as shown in Figure 14, was presented revealing that the two variables were linearly related such that as the attribute trialability increased the intent to use increased. The regression equation for predicting the intent to use, given trialability, was

$$\textit{Predicted Intent to Use} = .12\ \textit{Trialability} + 5.63. \qquad (5)$$

An intent to use value of 5.63, which reflected the regression equation y-intercept value when trialability theoretically equaled zero, was interpreted as a propensity to use cloud-computing technology between *agree slightly* and *agree*. The 95% confidence interval for the slope, .04 to .21, did not contain the value zero, and therefore trialability was significantly related to intent to use.

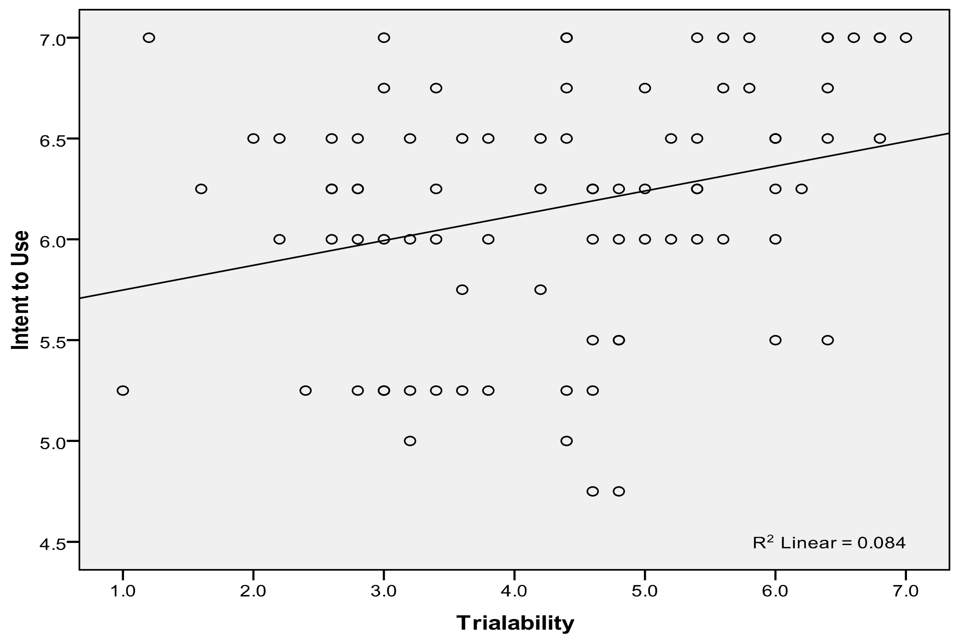

Figure 14. Scatterplot mapping trialability and intent to use coordinates. The coordinates, best-fit line, and R^2 coefficient were based on the normalized dataset.

The significance tests for the bivariate regression analysis included the *t* test associated with the SPSS coefficients table output. The bivariate linear regression test result was significant, $t(84) = 2.78$, $p < .01$. The magnitude of the standardized correlation coefficient was medium, .29, evidencing that trialability was moderately related to intent to use. Approximately 8% of the variance of the intent to use was associated with trialability. As hypothesized, the $H5_0$ null hypothesis was rejected ($p <$

.01), and trialability was positively correlated to intent to use. Therefore, based on these findings the fifth hypothesis, H5, was supported. The conclusion related to the fifth research question was interpreted based on the statistical analysis findings indicating that trialability was correlated to intent to use in a moderate positive degree.

Research Question 6 Findings

The sixth research question asked: To what extent does results demonstrable, a perceived attribute of innovation, relate to small business leaders' intent to use cloud-computing services? The variable construct results demonstrable was operationally defined as the perceived degree to which tangible evidence of the benefits of a cloud-computing technology is communicable. Guided by a review of the literature related to the cloud-computing ecosystem and the theoretical framework, the sixth hypothesis was framed theorizing that, during the prediffusion stage, the higher the level small business leaders perceived the results demonstrable of cloud computing the greater their propensity to adopt the innovation. The null hypothesis $H6_0$ was stipulated: No correlation exists between results demonstrable and intent to use cloud computing.

A linear regression analysis was performed to evaluate the prediction of intent to use cloud-computing technology based on small business leaders' perceived results demonstrable of cloud-computing innovation. The scatterplot diagram depicting results demonstrable and intent to use, as shown in Figure 15, was presented revealing that the two variables were linearly related such that as the attribute results demonstrable increased the intent to use increased. The regression equation for predicting the intent to use, given results demonstrable, was

$$\textit{Predicted Intent to Use} = .23\ \textit{Results Demonstrable} + 4.71. \quad (6)$$

An intent to use value of 4.71, which reflected the regression equation y-intercept value when results demonstrable theoretically equaled zero, was interpreted as a propensity to use cloud-computing technology between *neither disagree nor agree* and *agree slightly*. The 95% confidence interval for the slope, .00 to .47, did not contain the value zero, and therefore results demonstrable was significantly related to intent to use.

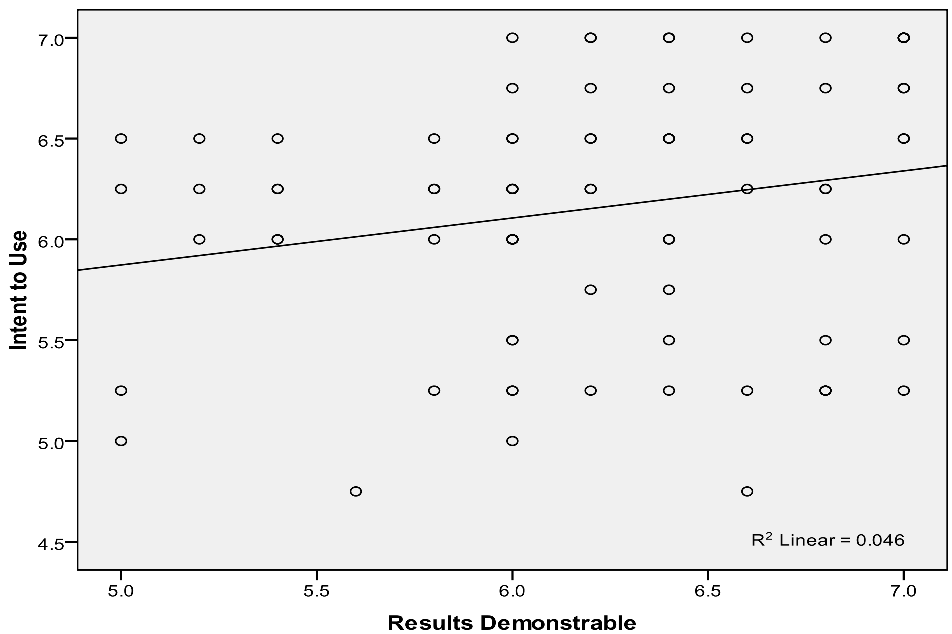

Figure 15. Scatterplot mapping results demonstrable and intent to use coordinates. The coordinates, best-fit line, and R^2 coefficient were based on the normalized dataset.

The significance tests for the bivariate regression analysis included the *t* test associated with the SPSS coefficients table output. The bivariate linear regression test result was significant, $t(84) = 2.01$, $p < .05$. The magnitude of the standardized correlation coefficient was between small and medium, .21, evidencing that results demonstrable was less than moderately related to intent to use. Approximately 5% of the variance of the intent to use was associated with results demonstrable. As hypothesized, the $H6_0$ null hypothesis was rejected ($p < .05$), and results demonstrable was positively correlated to intent to use. Therefore, based on these findings the sixth hypothesis, H6, was supported. The conclusion related to the sixth research question was interpreted based on the statistical analysis findings indicating that results demonstrable was correlated to intent to use in a slightly moderate positive degree.

Research Question 7 Findings

The seventh research question asked: To what extent does voluntariness, a perceived attribute of innovation, relate to small business leaders' intent to use cloud-computing services? The variable construct voluntariness was operationally defined as the perceived degree of self-determined sovereign choice to use cloud-computing technology. Guided by a review of the literature related to the cloud-computing ecosystem and the theoretical framework, the seventh hypothesis was framed theorizing that, during the prediffusion stage, the more mandatory small business leaders perceived the voluntariness of cloud computing the greater their propensity to adopt the innovation. The null hypothesis $H7_0$ was stipulated: No correlation exists between voluntariness and intent to use cloud computing.

A linear regression analysis was performed to evaluate the prediction of intent to use cloud-computing technology based on small business leaders' perceived voluntariness of cloud-computing innovation. The scatterplot diagram depicting voluntariness and intent to use, as shown in Figure 16, was presented revealing that the two variables were not significantly related in a linear manner. The regression equation for predicting the intent to use, given voluntariness, was

$$\textit{Predicted Intent to Use} = -.01\ \textit{Voluntariness} + 6.22 \qquad (7)$$

An intent to use value of 6.22, which reflected the regression equation y-intercept value when voluntariness theoretically equaled zero, was interpreted as a propensity to use cloud-computing technology between *agree* and *strongly agree*. The 95% confidence interval for the slope, -.27 to .25, did contain the value zero, and therefore voluntariness was not significantly related to intent to use.

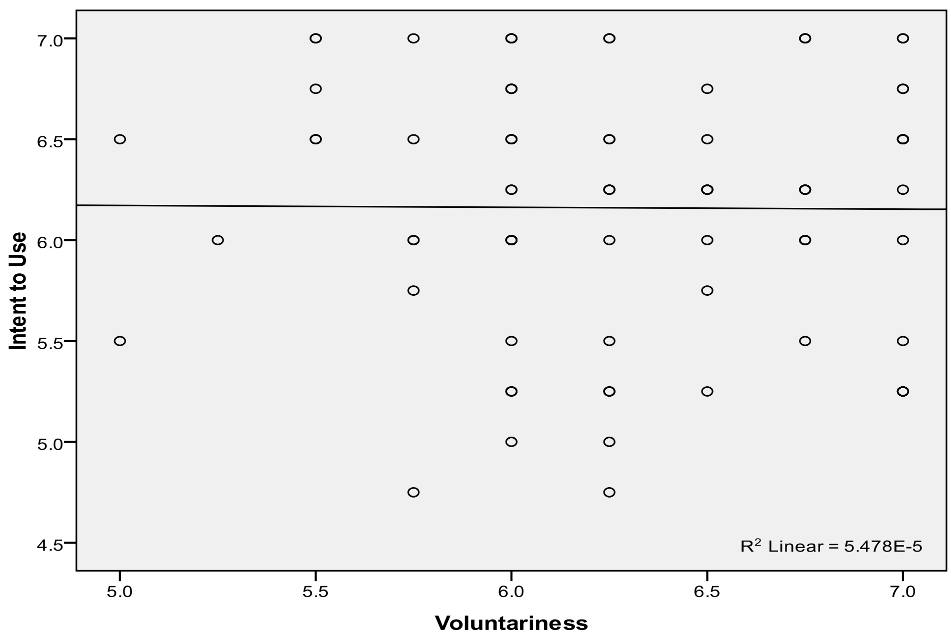

Figure 16. Scatterplot mapping voluntariness and intent to use coordinates. The coordinates, best-fit line, and R^2 coefficient were based on the normalized dataset.

The significance tests for the bivariate regression analysis included the *t* test associated with the SPSS coefficients table output. The bivariate linear regression test result was not significant, $t(84) = -.07$, $p = .95$. The magnitude of the standardized correlation coefficient was negligibly small, -.01, evidencing that voluntariness was not significantly related to intent to use. None of the variance of the intent to use was associated with voluntariness. As hypothesized, the $H7_0$ null hypothesis was not rejected ($p = .95$). Therefore, based on these findings the seventh hypothesis, H7, was not supported. The conclusion related to the seventh research question was interpreted based on the statistical analysis findings indicating that voluntariness was not significantly correlated to intent to use.

Research Question 8 Findings

The eighth research question asked: Which has a stronger relationship to small business leaders' intent to use cloud-computing services the perceived attribute of innovation relative advantage or voluntariness? Based on the theoretical framework, the eighth hypothesis was conceived theorizing that, during the prediffusion stage, small business leaders' perceived the relative advantage of cloud computing was more strongly related to their propensity to adopt the innovation than the strength of relationship between their perceived voluntariness and propensity to adopt cloud computing. The null hypothesis, $H8_0$, was stipulated: Voluntariness has an equal or greater correlation with intent to use cloud computing than does relative advantage.

A multiple linear regression analysis was performed to evaluate the distinction between small business leaders' perceived cloud-computing attributes relative advantage and voluntariness in predicting intent to use cloud-computing technology. The scatterplot overlay, as shown in Figure 17, was presented revealing that the correlation between the attribute relative advantage and intent to use depicted a positive linear slope while depicting an insignificant linear slope for correlation between the attribute voluntariness and intent to use. The multiple linear regression equation for predicting the intent to use, given relative advantage and voluntariness, was

$$\textit{Predicted Intent to Use} = .49\ \textit{Relative Advantage} + .04\ \textit{Voluntariness} + 2.97. \quad (8)$$

An intent to use value of 2.97, which reflected the regression equation y-intercept value when relative advantage and voluntariness theoretically equaled zero, was interpreted as a propensity to use cloud-computing technology near *disagree slightly*. The 95% confidence interval for the slope associated with predictor relative advantage, .26 to .72, did not contain the value zero while the 95% confidence interval for the slope for voluntariness, -.20 to .28, did contain the value zero. Therefore, based on the multiple regression analysis 95% confidence intervals, relative advantage was deemed significantly related to intent to use while voluntariness was not significantly related to intent to use.

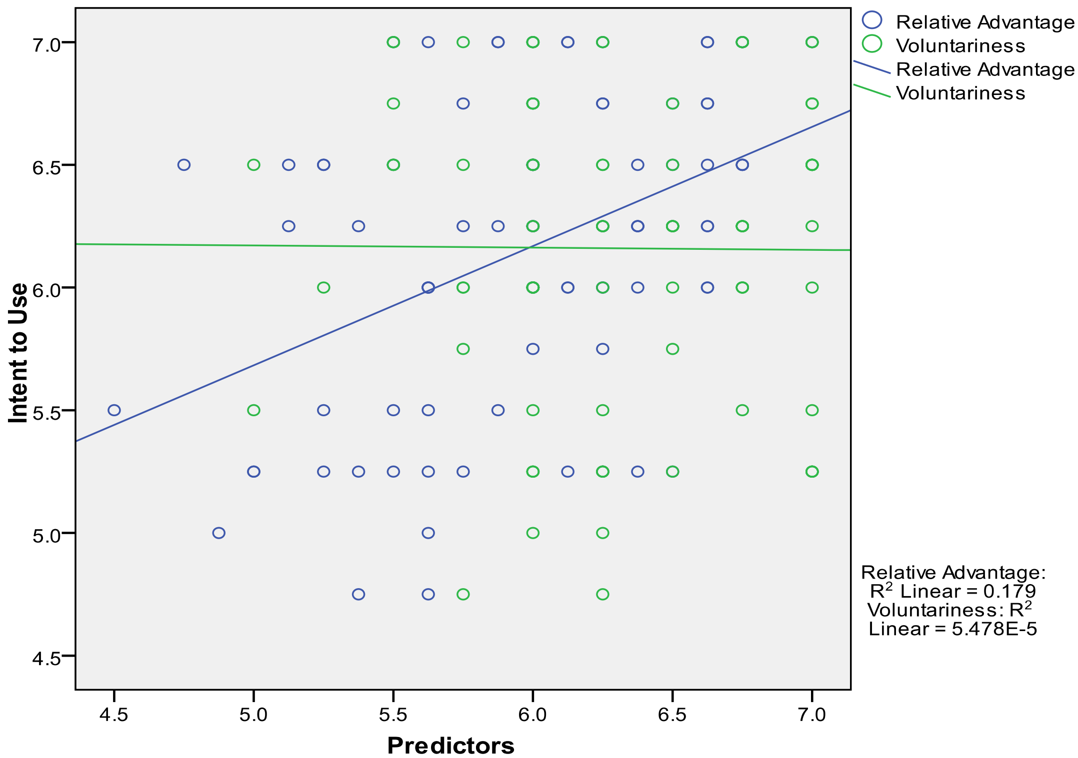

Figure 17. Scatterplot overlay mapping relative advantage and voluntariness with intent to use coordinates. The coordinates, best-fit lines, and R^2 coefficients were based on the normalized dataset.

The significance tests for the multiple regression analysis included the *t* test for each predictor with relative advantage was reported as $t(83) = 4.27$, $p < .01$ and voluntariness was reported as $t(83) = .34$, $p = .73$. The magnitude of the standardized correlation coefficients related to intent to use were reported as medium, .43, for relative advantage while insignificantly small, .03 for voluntariness. As hypothesized, the $H8_0$ null hypothesis was rejected on the basis of the strength of correlation between relative advantage and intent to use that was significant ($p < .01$) appearing greater than the strength of correlation between voluntariness and intent to use that was not significant ($p = .73$). Therefore, based on these findings the eighth hypothesis, H8, was supported. The conclusion related to the eighth research question was interpreted based on the statistical analysis findings indicating that relative advantage was correlated to intent to use in a greater than moderate positive degree while voluntariness was not significantly correlated to intent to use.

Summary Findings

Anchored in a prediffusion stage DOI theoretical framework, the overall intent of this study was to examine the relationship between the perceived innovation attributes of cloud-computing technology and small business leaders' intent to use cloud computing. The study intent was summarized by the overarching research question: What is the propensity of small businesses to embrace the cloud-computing novel business-computing paradigm? The analysis of the survey data collected for this study based on the normalized dataset resulted in findings indicating significance in the relationship between each cloud-computing attribute and intent to use cloud-computing technology with the exception of the attribute voluntariness. The analysis findings were interpreted indicating no significant relationship between the attribute voluntariness and intent to use cloud-computing technology. The study findings are highlighted in Figure 18 by depicting correlation coefficient values for each hypothesized predictor and criterion variable relationship based on the predictive DOI theoretical framework applied to this inquiry.

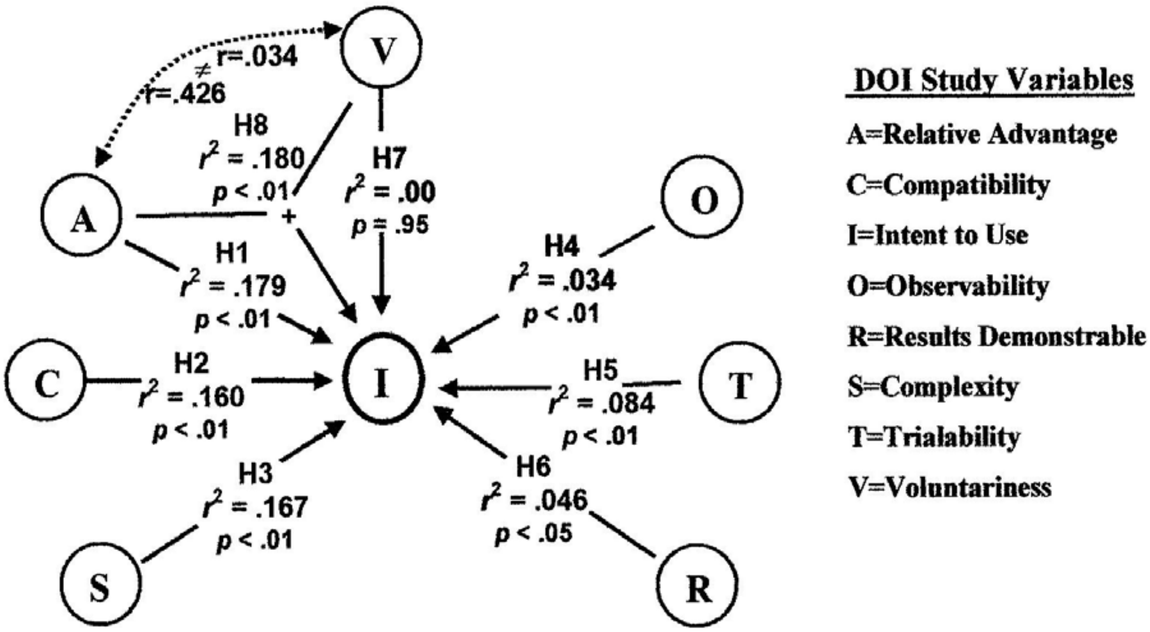

Figure 18. Predictive DOI theoretical framework with hypotheses regression analysis results. The theoretical framework conceptualization was designed to depict the predictor and criterion variable relationship for each research question hypothesis. The correlation coefficient (r^2) is presented for each hypothesis indicating the strength of relationship assessment.

The cloud-computing attributes relative advantage, compatibility, and complexity were found to have a greater than moderate correlation to intent to use. These correlation findings were consistent with other adoption inquiry electing to limit the measures of innovation attributes to relative advantage, compatibility, and complexity because of their strength of relationship with intent to use (Chong et al., 2009; Conrad, 2010; Rouibah & Hamdy, 2009). In particular, prior research projected that the relative advantage of cloud computing for small business was expected significant (Buyya et al., 2009; Etro, 2009; Gens et al., 2010; Greengard & Kshetri, 2010).

The cloud-computing attributes trialability, results demonstrable, and observability were found to have a less than moderate correlation to intent to use while voluntariness was found not significantly correlated to intent to use. These findings were mostly congruent with Valier et al.'s (2008) open source software research results. Valier et al. reported findings indicating that the relationships between each perceived innovation attribute and use intent were statistically significant with the exception of the correlation between voluntariness and use intent. The current study's finding related to trialability was consistent with Conrad's (2010) DOI study of individuals' willingness to use personal web servers based on the factors relative advantage, complexity, and trialability. Moreover, Conrad reported a positive correlation between complexity and trialability, which suggested the opportunity for further analysis of this study's data beyond the initial hypothesis.

The cloud-computing innovation attributes most strongly related to small business leaders' intent to use the emerging technology included relative advantage, compatibility, and complexity. The attributes relative advantage, compatibility, and complexity were aligned more closely with the characteristics of the novel cloud-computing business paradigm (Katzan, 2008, 2010; Mell & Grance, 2010; Truong 2010). Representing key indicators for small business cloud-computing adoption, these findings were tied to effective business practice as opportunity for economic value and competitive advantage attributed to the cloud-computing business paradigm innovation, which included an operationalized versus capitalized cost structure and an elastic global scale. Access to capital financing and large-firm competition were portrayed in the research literature as constraints to small business viability and economic contributions (Barringer & Ireland, 2010; Liao et al., 2008). Perceived competitive advantage improvements attributed from the cloud-computing business paradigm were projected to be a significant factor in small businesses use of cloud computing (Sharif, 2010; Truong, 2010).

The cloud-computing innovation attributes trialability, results demonstrable, and observability were identified with the commercialization aspects of the cloud-computing ecosystem. The extant research has shown cloud-computing technology was iteratively re-inventive and not fully progressed to the commercialization stage of the innovation-development process (Etro, 2009; Rogers, 2003). Ambiguity related to the cloud-computing technology standards and commercialization maturity (Armbrust et al., 2010; Blaskovich, & Mintchik, 2011; Buyya et al., 2009; Vouk, 2008) could have factored into the less than moderate correlation between the perceived attributes trialability, results demonstrable, and observability and small business leaders' intent to use cloud computing. The propensity to use and the adoption rate of IT innovation has been shown to improve competitive advantage (Conrad, 2010; Truong, 2010). The current study's findings related to the cloud-computing attributes trialability, results demonstrable, and observability were linked to effective business practice by advocating opportunity for improved commercialization of cloud-computing technology.

A review of the literature (Bennett, 2009; Mell & Grance, 2009; Sharif 2010; Smith, 2009; Wyld, 2009) indicated that policy and regulatory mandates have influenced pre-commercialization adoption of cloud-computing technology by large companies and federal government public sector agencies. The hypothesized relationship between voluntariness and intent to use was not supported suggesting that the large company and public sector cloud-computing mandates were not found to have a similar influence on small business leaders' propensity to adopt cloud computing. The perceived degree of voluntariness appeared to have no significant correlation with small business leaders' intent to use cloud computing, which was congruent with Valier et al.'s (2008) prediffusion stage DOI research results related to open source software.

The conceptualization of voluntariness into the construct categories mandatory and voluntary potentially introduced biases with respect to other research questions. A determination of whether the study's finding holds true when the data is segregated by the voluntariness categories mandatory (voluntariness values less than four) or voluntary (voluntariness values equal to or greater than four) was considered beyond the scope of this research study. Follow-up post hoc analysis is recommended based on the voluntariness categories mandatory and voluntary.

Based on the sampled small business leaders, on average, the study participants indicated a negligible degree of trialability, moderately low degrees of complexity and observability, and comparatively high degrees of relative advantage, compatibility, results demonstrable, voluntariness, and intent to use cloud-computing technology. The findings related to a high degree of intent to use differed from prior research (Buyya et al., 2009; Etro, 2009; Gens et al., 2010) that suggested lower technology innovation adoption tendencies by small businesses. However, this study's findings related to a high degree of intent to use was congruent with prior research that recognized small businesses were sophisticated adopters of IT as a competitive tool (Chalhoub, 2010;

Dibrell et al., 2008). The low percentage of firms indicating extant use of cloud-computing technology and the types of cloud-computing technology used by these small businesses were consistent with the findings of prior research (Schadler, 2009; Truong, 2010; Wyld, 2009).

The researcher acknowledged a number of inherent study limitations including the convenience sampling based on the entire small business e-mail list maintained by ACA. The study participants' indication of a high degree of intent to use signaled the potential for self-selection bias, which arises when individuals select themselves to participate in research derived from nonprobability sampling (Heckman, 1979; Melino, 1982). A related assumption included participant self-reporting bias, which occurs when a participant's experience, self-perception, and work environment influence their survey responses (Han & Anantatmula, 2007). Valier et al.'s (2008) prediffusion stage DOI probability sample research results were examined as a baseline (Blaskovich & Mintchik, 2011; Norton, Dow, & Do, 2008; Sampat, 2007) revealing a nearly identical high degree of intent to use compared with this study's results. The reviewer's interpretation of the analysis and findings presented in this research project were advised within the context of these limitations.

This study's conclusions and findings were framed as a basis for evidencing the significance of this research project. The current study's significance was demonstrated by contributing to the academic literature via addressing the gap identified in extant research concerning small businesses' penchant to adopt cloud-computing innovation. The significance of this study was demonstrated further by the prospect of applying the study's findings to professional practice as well as recognizing the research results' potential implications for positive social change.

Applications to Professional Practice

The focal consequence of this research project resided in applicability of the study findings to the professional practice of business. This study's significance was realized by identifying means for transforming the theoretical conclusions and findings into the potential tangible benefits attributed via professional practitioner application. Numerous opportunities to apply the study findings to professional practices were identified. However, the application of the study findings was prioritized by emphasizing two facets of small business economic vitality consisting of a cloud-computing deployment strategy and a cloud-computing commercialization strategy.

Cloud-Computing Deployment Strategy

A holistic conceptualization of the novel cloud-computing business paradigm was presented in this study including the synergistic integration IT components, IT capability resourcefulness, and the operationalized capital-cost financial model. The cloud-computing ecosystem depicted in Figure 4 was presented to illustrate the technology building-block components of cloud computing including IaaS, PaaS, SaaS, and other technologies in conjunction with service delivery approaches such as private, community, public, and hybrid clouds. The characteristics attributed to the cloud-computing ecosystem highlighted IT capabilities such as on-demand self-service, ubiquitous access, rapid elasticity, resource pooling, massive scale, metered services, and other IT facilities. Moreover, the traditional front-loaded capital intense IT financial model was reconstituted into an operationalized economic IT capability via the novel cloud-computing business model.

The attributes of cloud-computing innovation examined in this study via the predictive DOI framework were measurements of the sample small business leaders' perceptions related to the cloud-computing ecosystem. As depicted in Figure 18, this study's findings indicated significant (*more than moderate*) correlations between each of the cloud-computing innovation attributes relative advantage, compatibility, and complexity and the sample small business leaders' intent to use cloud computing. The significance of these correlation findings was accompanied by the sampled small business leaders' indication, on average, of a moderately low degree of complexity in conjunction with relatively high degrees of relative advantage, compatibility, and intent to use cloud-computing technology.

Notwithstanding the acknowledged limitations of this research project, this study's findings were deemed applicable to business by offering a lens for examining the cloud-computing ecosystem for intended use. Examining cloud-computing technologies via the cloud-computing attributes relative advantage, compatibility, and complexity were projected to provide a viable framework for gauging small businesses' use propensity. This study's findings were contemplated to inform small businesses formulation of cloud-computing deployment strategies that leveraged its novel business-computing paradigm. Moreover, these research results were expected to promote deployment of competitive small business strategies by incorporating the potential benefits and capabilities attributed to the cloud-computing ecosystem. The current study's findings were recommended to serve as a baseline for assessing the effectiveness of cloud-computing deployment strategies for small businesses.

The findings from this study were interpreted as potentially signaling that the time was opportune to shift the traditional IT strategy from a finite resource-based view to a strategic perspective based on resourcefulness. Enabled by the operationalized pay-for-use and global-scale IT capability of cloud-computing innovation, the resourcefulness strategic perspective was envisaged to overcome the financial capital costs and large-company economy-of-scale advantage hindering small business economic viability. Developing cloud-computing resourcefulness strategies was predicted to ignite small business and entrepreneurial innovation via novel IT capabilities and disruptive creation of products and service.

Cloud-Computer Commercialization Strategy

Strengthening the economic vitality of small business was shown to transcend to economic community value while cultivating future returns via incubation of ongoing entrepreneurial innovation. Given the dominating numbers of small businesses compared to the number of large firms, the small business marketplace was forecasted as a potentially large consumer of the cloud-computing ecosystem. Maturing the cloud-computing ecosystem beyond the prediffusion stage more fully into the commercialization stage of the innovation-development process was anticipated to offer significant economic contribution to and through small businesses. Cloud-computing service providers and community policymakers were deemed to have vested interests in promoting the commercialization of cloud computing for adoption by small businesses.

The cloud-computing attributes trialability, results demonstrable, and observability were examined via the predictive DOI framework as means for assessing the sample small business leaders' perceptions in context of the commercialization aspects of the cloud-computing ecosystem. As shown in Figure 18, this study's findings indicated significant (*slightly moderate*) correlations between the cloud-computing attributes observability, results demonstrable, and trialability and the sampled small business leaders' intent to use cloud-computing technology. The significance of these correlation findings was accompanied by the sampled small business leaders' indication, on average, of a moderately low degree of observability and a negligible degree of trialability in conjunction with a relatively high degree of results demonstrable.

This study's findings related to observability, results demonstrable, and trialability were deemed applicable to cloud-computing service providers by informing their commercialization strategies related to cloud-computing technologies. Recognizing the potential for improving small business leaders' perceptions related to the cloud-computing attributes observability and trialability offered opportunities for cloud-computing service providers. Specifically, cloud-computing service providers were advised to apply this study's findings in context of the predictive DOI framework by tailoring commercialization strategies related to cloud-computing products and services to address the needs and abilities of small business as opposed to large-firm cloud-computing offerings. This study's findings were recommended to serve as a baseline for assessing the effectiveness of cloud-computing service providers' commercialization strategies for small businesses. The findings from this study were interpreted as potentially signaling that the time was opportune for cloud-computing service providers to capitalize on early small business marketplace leadership.

Moreover, the study's findings were anticipated to inform community, industry, and academic policymakers as a motivation for formulating commercialization strategies related to cloud computing. These strategies were conceived to entail targeted incentives for collaborative transfer of cloud-computing academic research to private entrepreneurial firms or targeted incentives for small business use of cloud-computing services for innovation. Agencies similar to the ACA were anticipated to use the study findings, in particular results demonstrable, to aid in collaborating with industry experts to promote cloud-computing awareness in conjunction with education programs for fostering economic development via small business sustainability and economic vitality. This study's findings were recommended to serve as a baseline for assessing the effectiveness of community, industry, and academic policymakers' commercialization strategies for small businesses. Additionally, the application of the study findings to professional practice served as the catalyst for implications related to social change.

Implications for Social Change

This research project's implications for social change transcended small business sustainability by contributing economic, societal, and environmental benefits. Founded on the study's significance, the implications for social change were derived from the application of this study's findings to professional practice, which emphasized strategies for cloud computing deployment and commercialization. The focal implications for social change were expressed in terms of tangible improvements related to workforce preparedness, environmental consciousness, and social entrepreneur enablement.

Workforce Preparedness

Anchored in a predictive DOI framework, this study's findings were instrumental for framing the cloud-computing deployment strategy as a targeted application to professional practice. An essential aspect of the cloud-computing deployment strategy was expected to focus on development of personnel skills. This study's findings related to the perceived degree of difficulty or simplicity attributed to understanding and using cloud-computing technology (complexity) were envisaged to inform small business leaders about the personnel skill implications for people who support IT and people who use IT to enact strategic outcomes.

These projected personnel skill implications were described in context of workforce preparedness. In the small business context, IT personnel have engaged tangibly in the deployment and support of the information systems technology. Requiring less hands-on contact with the technology, cloud-computing IT skills were envisaged to consist of virtual management and deployment of small business IT via the cloud-computing ecosystem. The cloud-computing support skills were projected to require greater governance and more tightly coupled integration with business strategy. Similarly, small business executives were projected to adapt to new business acumen associated with the cloud computing business paradigm. New skills were envisaged to replace extant business strategies and performance metrics via operationalized proforma and elastic global-scalable computing resources.

In essence, the societal implications related to small businesses were projected to signal the obsolescence and transformation of designated personnel skills. The results from this research project were planned to inform small business leaders' forecast of personnel skill requirements essential for sustainable advantage. While elevating workforce competencies, developing personnel skills were projected to influence reciprocally the perceptions about the cloud-computing attribute complexity for improved use of cloud-computing technology.

Environmental Consciousness

Environmental concerns related to energy consumption and electronic-equipment waste have grown to global proportions. Many regulatory agencies and nongovernmental organizations (NGOs) have developed strategies to deal with these environmental concerns. Transcending the economic benefits attributed to small business adoption of the cloud-computing ecosystem, cloud-computing innovation was reported as consuming approximately one third less energy and significantly reducing electronic equipment disposal. In particular, the perceptions associated with betterment in lieu of precursor ideas (relative advantage), results visibility to others (observability), and congruence with experiences, values, and needs (compatibility) were envisioned to be inspired partially by environmental consideration.

This study's findings were projected to signal the potential for cloud-computing deployment and commercialization strategies. The targeted cloud-computing strategies were anticipated to have significant positive implications for small businesses by decreasing energy consumption and reducing electronic equipment waste. Moreover, these implications were envisaged potentially to enlighten policymakers regarding the prioritization of regulatory and NGO environmental strategies for even greater environmental outcomes.

Social Entrepreneur Enablement

Social entrepreneurs resemble business entrepreneurs in many tangible ways. Business entrepreneurs have been characterized as innovating and incubating solutions to industry-wide business problems. Similarly, social entrepreneurs have been recognized for identifying and solving social problems of a grand scale. Throughout generations, social entrepreneurs have engaged in societal callings. The societal results of social entrepreneurship have reached global proportions because of the Internet, social media, and the use of other information technologies.

Although social entrepreneurs typically are not profit motivated, the operationalized IT capability projected via the novel cloud-computing business model was envisaged to provide economic value to social entrepreneurs. The relative advantage attributed to cloud-computing innovation ascribed to small businesses was thought potentially to offer similar positive implications for social entrepreneurs. The perceptions associated with betterment in lieu of precursor ideas, degree of difficulty or simplicity, and congruence with experiences, values, and needs were considered similarly perceived by social entrepreneurs. This study’s findings were considered applicable to social entrepreneurs signaling the advantage of examining the transferability of small business cloud-computing deployment strategies for the benefit of social entrepreneurs and other nonprofit organizations.

Recommendations for Action

The recommendations for action presented in this study were developed as a prioritized logical response to the application of the study findings to the professional practice of business. The conclusions drawn from this study's findings were reported indicating significant correlations between perceived cloud-computing attributes and small business leaders' intent to use cloud-computing technology. This study's findings were interpreted as potentially signaling that the time was opportune for shifting the traditional IT business strategy to the operationalized economic IT capability characterizing cloud computing and improving cloud-computing commercialization perspectives for small businesses. The primary audience summoned to action included small business IT deployment decision-makers and cloud-computing commercialization policymakers.

Although numerous recommendations were formulated as logical response to the study conclusions, the proposals were culled to immediate prerequisite initiatives serving as building-block steps to useful action. The call to action included three distinct recommendations: dissemination of the study results, collaboration to formulate a small business cloud-computing deployment framework, and a summons for further small business cloud-computing research, which is discussed in the Recommendation for Further Study section.

Diffusion of Study Results

The highest value related to study conclusions was anticipated to reside with the small business IT deployment decision-makers and cloud-computing commercialization policymakers. To promote optimal outcomes, dissemination of the study results to the targeted audience was deemed essential. Based on DOI theory, viral communication within members of the target audience was perceived the most effective means for the dissemination of the study results. To facilitate this objective, prerequisite steps for broadcasting the study findings were proposed including (a) publication of this doctoral study via an online dissertation library for widespread circulation, (b) publication of a summary report of the study results via Internet and e-mail distribution, and (c) in-person presentation of the study results.

Publication of this doctoral study was planned using ProQuest as a means to provide online access to a vast group of academic and practitioner researchers. In satisfaction of the commitment to supply the study results to requesting survey participants, a summary report highlighting the study results was planned. Distribution of the summary report was planned via e-mail to study participants opting to receive the study results. Additionally, access to the summary report of study results was intended as a small business resource via ACA's website as well as other websites.

By invitation, the researcher has committed to present the study results in person to forums of small business leaders and entrepreneurs. The forums were planned as a means for personal presentation of the study results envisioning interactive opportunities for study results diffusion. These personal presentation settings were anticipated to provide a channel for potentially launching small business cloud-computing deployment collaboration.

Cloud-Computing Deployment Collaboration

A few small business recipients of the ACA announcement soliciting survey participation have contacted the researcher requesting collaboration regarding the development of cloud-computing deployment strategies. These small businesses have assessed, in varying degrees of sophistication, the potential strategic benefit of cloud-computing technology for their respective firms. In response to the personal presentations of the study results, additional small businesses were anticipated to join the cloud-computing deployment collaboration. Additionally, cloud-computing service providers were projected to participate in the small business cloud-computing deployment collaboration.

The small business cloud-computing deployment collaboration was envisaged as a focus group for constructing a small business cloud-computing deployment framework based on the current study findings. As each small business has varying degrees of capabilities, the development of the small business cloud-computing deployment framework was projected to be an incremental and iterative process. Based on strategic commitment and resource allocation, collaborating small business leaders were anticipated to perform pilot testing of aspects of cloud-computing deployment framework in their professional practice.

Recommendations for Further Study

Throughout the course of this research project opportunities for further study were noted. Opportunities for additional research were identified in the study limitations, application of the theoretical framework, literature review, and implication for social change. Based on these observations, specific recommendations for further study are proposed.

The convenience sample based on the entire small business e-mail list maintained by ACA was identified as a potential study limitation. The generalization of the study's findings was limited potentially to the study population and was not implied beyond. Replicating this study based on a randomized sample of a broader sampling frame was recommended for further study. Moreover, comparing the results of this study against the additional research conclusions and findings was also recommended.

As an alternative to the DOI framework, the systems of innovation approach was recommended for understanding the use of cloud-computing technology by small businesses. Applying the SIA framework was proposed for further study to explore unconventional constructs related to economic, social, political, organizational, institutional, and other factors that affect the diffusion and use of innovation. Comparing the findings and conclusions of research based on the SIA framework against this study's results were thought to add a considerably broad understanding of small businesses' use of cloud-computing technology for economic vitality and sustainability.

The extant academic literature was virtually void of research related to small business use of cloud computing to create and sustain their competitive advantage. Building upon this study's findings, further research is warranted to examine how cloud-computing deployment strategies can enable small businesses to create and sustain their competitive advantage. This recommended inquiry was thought to offer significant economic development opportunities to and through small businesses.

The preponderance of extant research about cloud computing was related to large-size organization. The conclusions presented in this study addressed a gap in understanding related to small business use of cloud computing. Although the mission results perspective between social entrepreneurs and small businesses are typically polar opposites, many of their strategies and key success factors are similar. To understand more fully this study's implications for social change, another recommendation for further study was the transferability of this study's conclusions and findings to social entrepreneurs and nonprofit organizations.

Reflections

Acknowledging small businesses' economic contributions, pursuing of a better understanding of the early adoption of cloud computing by small business was rewarding. Advancing the predictive DOI theory by examining the relationship between small business leaders' perceived cloud-computing attributes and their intent to use cloud computing, this research project was designed with the expectation for application to professional practice and the hope for positive societal implications. The rewards derived from this research project were experienced beyond scholarly benefit by envisaging practitioner value via application of this study' findings for improved business outcomes while recognizing positive implications for social change.

The researcher entered this project as a small business owner and entrepreneur possessing more than 20 years of industry experience fostering IT agility and facilitating strategically aligned IT innovations to achieve enterprise competitive advantage. A conscious effort was made to ensure objectivity by mitigating the possibility of researcher bias. Because of the nature of the quantitative cross-sectional survey strategy in conjunction with strict adherence to ethical research practices, the researcher's experience was not perceived as posing a material bias to this study.

Although the researcher entered this project with a working understanding related to the theoretical framework of DOI, a greater appreciation and understanding was gained for the complexities associated with cloud-computing innovation attributes' influence on intent to use cloud computing in a prediffusion context. The researcher developed an acute awareness of the importance and potential economic and societal value associated with the research findings related to small businesses propensity to adopt cloud-computing technology. Moreover, application of the correlated study conclusions to professional practice was projected possibly to signal a more rapid adoption rate of cloud computing by small business, which potentially can improve the small business economic contributions attributed to cloud computing by a factor of five times greater versus a slow adoption rate.

Summary and Study Conclusions

Given small businesses' economic and societal contributions, understanding small business leaders' propensity to adopt the novel cloud-computing business paradigm is relevant in an era of economic turmoil and global competitiveness. A quantitative research method using a nonexperimental cross-sectional survey design was employed to examine the relationship between small business leaders' perception of cloud-computing innovation attributes and their propensity to adopt this emerging technology. A predictive DOI framework using a pretested survey instrument was adopted to examine small business leaders' intent to use cloud-computing technology and their perceptions about cloud-computing attributes including relative advantage, compatibility, complexity, observability, trialability, results demonstrable, and voluntariness.

ACA cooperated in this research project by using their entire active e-mail list of small businesses to solicit participation in this study's online survey. Equaling slightly less than a 4% response rate, 151 completed participant responses were collected via this study's web-hosted survey instrument. Based on the survey data collected, SPSS software was used to perform descriptive statistics, reliability and validity analysis, and statistical procedures for testing the hypotheses derived from this study's eight research questions. The results of the statistical analysis supported each of the hypotheses with the exception of the seventh hypothesis associated with voluntariness.

Interpretation of this study's findings indicated significant (*more than moderate*) correlations between the cloud-computing attributes relative advantage, compatibility, and complexity and intent to use cloud computing; significant (*slightly moderate*) correlations between the cloud-computing attributes observability, results demonstrable, and trialability and intent to use cloud computing; and no significant correlation between the cloud-computing attribute voluntariness and intent to use cloud-computing technology. The significance of these correlation findings was accompanied by the sampled small business leaders' mean indication of a negligible degree of trialability, moderately low degrees of complexity and observability, and comparatively high degrees of relative advantage, compatibility, results demonstrable, voluntariness, and intent to use cloud-computing technology.

Notwithstanding the acknowledged limitations of this research project, the conclusions drawn from this study's findings were deemed to offer a lens for developing strategies to promote rapid small business adoption of cloud-computing technology. Examining cloud-computing technologies via the attributes relative advantage, compatibility, and complexity were envisaged to provide a viable framework for gauging small businesses' use propensity while offering understanding needed to formulate cloud-computing deployment strategies that leverage its novel business-computing paradigm. Evaluating cloud-computing technologies via the attributes observability, results demonstrable, and trialability were envisaged to provide a viable framework for gauging small businesses' adoption propensity while offering understanding needed to formulate cloud-computing commercialization strategies. The results from this research project were anticipated to serve not only as a benchmark for assessing small businesses' propensity to use cloud-computing technology but also as a catalyst for promoting rapid adoption of cloud computing via deployment and commercialization strategies advocated.

This study's conclusions and findings were framed as a basis for evidencing the study's significance. The study's significance was partially demonstrated by contributing to the academic literature by addressing the gap identified in extant research concerning small businesses' penchant to adopt cloud-computing innovation. The significance of this study was further substantiated via the prospect of applying the findings from this research project to professional practice by advocating small business cloud-computing deployment and commercialization strategies. The study's significance also was cast by recognizing the potential implications for positive social change that were expressed in terms of tangible improvements related to workforce preparedness, environmental consciousness, and social entrepreneur enablement.

The findings from this research project were encouraging by offering a framework for gauging small businesses' penchant to use cloud-computing technology, which potentially signaled a new era in small business sustainability and economic contributions. Equally encouraging was the initial response from small businesses desiring to collaborate regarding the development of a framework for cloud-computing deployment strategies.

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Appendix A: Sample PreDOI Survey Instrument

Small Business Adoption of Cloud Computing

General Participant Survey Questions

Instructions:
This section of the survey requires you to respond to questions by selection the most appropriate choice from the various alternatives. Answering the questions below should not take more than three to five minutes. On your web browser, merely click on the check box immediately preceding your selection. Follow the survey navigation controls to advance between questions. If for some reason you prefer not to answer a question merely proceed to the next question. After you have entered responses to this section you will advance to the next section to specify your perceptions of cloud computing innovation. At the end of the survey you will have the opportunity to see all your responses and edit them before final submission.

A. What responsibility most represents you?

○ Executive ○ Technology ○ Information Technology ○ Operations ○ Finance

○ Other (please specify)

B. Which range includes your age?

○ <20 ○ 21-30 ○ 31-40 ○ 41-50 ○ 51-60 ○ >60

C. What is your gender?

○ Female ○ Male

D. What is you education level?

○ High School ○ Some College ○ Bachelor ○ Master ○ Doctorate

E. How many years of full-time work experience do you have?

○ <1 ○ 1-10 ○ 11-20 ○ 21-30 ○ 31-40 ○ >40

F. What is the legal structure of your organization?

○ Proprietorship ○ Partnership ○ LLC ○ Corporation ○ Other

G. How many employees does your organization have?

○ 0-9 ○ 10-49 ○ 50-249 ○ 250-499 ○ >499

H. How many years has your organization been in business?

○ <6 ○ 6-10 ○ 11-20 ○ 21-30 ○ >30

I. Which range includes your organization's annual revenue amount?

○ <$2Million ○ $2-10Million ○ $11-50Million ○ >$50Million

Small Business Adoption of Cloud Computing

J. In which industry is your organization?

K. Select all cloud computing technologies used by your organization.

- None
- SaaS
- IaaS
- PaaS
- Other (please specify)

L. How many years have you known about cloud computing?

- <1
- 1-3
- 4-6
- 7-9
- >9

M. Have you attended any presentations about cloud computing?

- Yes
- No

N. Have you read any advertisements about cloud computing?

- Yes
- No

O. Have you talked to colleagues about cloud computing?

- Yes
- No

P. Have you previously used cloud computing?

- Yes
- No

Small Business Adoption of Cloud Computing

Cloud Computing Research Survey Questions

Answering the questions in this section should not take more than ten to twelve minutes. On your web browser, merely click on the check box indicating your selection. Follow the survey navigation controls to advance between questions. At the end of the survey you will have the opportunity to see all your responses and edit them before final submission. After submitting your responses, solely at your discretion, you will have the opportunity to submit your e-mail, which will be kept confidential, solely for the purpose to receive a complementary copy of the research results.
For each of the statements the in next section, please indicate your level of agreement with the statement by clicking the appropriate check box associated with the statement. Please select if you strongly disagree, disagree, disagree slightly, neither disagree or agree, disgree slightly, agree, or strongly agree.

1. Using cloud computing is compatible with all aspects of my work.

○ strongly disagree ○ disagree ○ disagree slightly ○ neither disagree or agree ○ agree slightly ○ agree ○ strongly agree

2. I think that using cloud computing fits well with the way I like to work.

○ strongly disagree ○ disagree ○ disagree slightly ○ neither disagree or agree ○ agree slightly ○ agree ○ strongly agree

3. Using cloud computing is completely compatible with my current situation.

○ strongly disagree ○ disagree ○ disagree slightly ○ neither disagree or agree ○ agree slightly ○ agree ○ strongly agree

4. Using cloud computing fits into my work style.

○ strongly disagree ○ disagree ○ disagree slightly ○ neither disagree or agree ○ agree slightly ○ agree ○ strongly agree

5. I believe that cloud computing is cumbersome to use.

○ strongly disagree ○ disagree ○ disagree slightly ○ neither disagree or agree ○ agree slightly ○ agree ○ strongly agree

6. My using cloud computing requires a lot of mental effort.

○ strongly disagree ○ disagree ○ disagree slightly ○ neither disagree or agree ○ agree slightly ○ agree ○ strongly agree

7. Using cloud computing is often frustrating.

○ strongly disagree ○ disagree ○ disagree slightly ○ neither disagree or agree ○ agree slightly ○ agree ○ strongly agree

8. My interaction with cloud computing is clear and understandable.

○ strongly disagree ○ disagree ○ disagree slightly ○ neither disagree or agree ○ agree slightly ○ agree ○ strongly agree

Small Business Adoption of Cloud Computing

20. Overall, I find using cloud computing to be advantageous in my work.

○ strongly disagree ○ disagree ○ disagree slightly ○ neither disagree or agree ○ agree slightly ○ agree ○ strongly agree

21. Using cloud computing gives me greater control over my work.

○ strongly disagree ○ disagree ○ disagree slightly ○ neither disagree or agree ○ agree slightly ○ agree ○ strongly agree

22. Using cloud computing increases my productivity.

○ strongly disagree ○ disagree ○ disagree slightly ○ neither disagree or agree ○ agree slightly ○ agree ○ strongly agree

23. I would have no difficulty telling others about the results of using cloud computing.

○ strongly disagree ○ disagree ○ disagree slightly ○ neither disagree or agree ○ agree slightly ○ agree ○ strongly agree

24. I believe I could communicate to others the consequences of using cloud computing.

○ strongly disagree ○ disagree ○ disagree slightly ○ neither disagree or agree ○ agree slightly ○ agree ○ strongly agree

25. The results of using cloud computing are apparent to me.

○ strongly disagree ○ disagree ○ disagree slightly ○ neither disagree or agree ○ agree slightly ○ agree ○ strongly agree

26. I would have difficulty explaining why cloud computing may or may not be beneficial.

○ strongly disagree ○ disagree ○ disagree slightly ○ neither disagree or agree ○ agree slightly ○ agree ○ strongly agree

27. I have had a great deal of opportunity to try various applications of cloud computing.

○ strongly disagree ○ disagree ○ disagree slightly ○ neither disagree or agree ○ agree slightly ○ agree ○ strongly agree

28. I know where I can go to satisfactorily try out various uses of cloud computing.

○ strongly disagree ○ disagree ○ disagree slightly ○ neither disagree or agree ○ agree slightly ○ agree ○ strongly agree

29. Before deciding whether to use cloud computing, I am able to properly try it out.

○ strongly disagree ○ disagree ○ disagree slightly ○ neither disagree or agree ○ agree slightly ○ agree ○ strongly agree

Small Business Adoption of Cloud Computing

30. I was permitted to use cloud computing on a trial basis long enough to see what it could do.

○ strongly disagree ○ disagree ○ disagree slightly ○ neither disagree or agree ○ agree slightly ○ agree ○ strongly agree

31. I am able to experiment with cloud computing as necessary.

○ strongly disagree ○ disagree ○ disagree slightly ○ neither disagree or agree ○ agree slightly ○ agree ○ strongly agree

32. My management expects me to use cloud computing.

○ strongly disagree ○ disagree ○ disagree slightly ○ neither disagree or agree ○ agree slightly ○ agree ○ strongly agree

33. My use of cloud computing is voluntary (as opposed to required by my management).

○ strongly disagree ○ disagree ○ disagree slightly ○ neither disagree or agree ○ agree slightly ○ agree ○ strongly agree

34. My management does not require me to use cloud computing.

○ strongly disagree ○ disagree ○ disagree slightly ○ neither disagree or agree ○ agree slightly ○ agree ○ strongly agree

35. Although it may be helpful, using cloud computing is certainly not compulsory in my organization.

○ strongly disagree ○ disagree ○ disagree slightly ○ neither disagree or agree ○ agree slightly ○ agree ○ strongly agree

36. I would use cloud computing even if it were not required.

○ strongly disagree ○ disagree ○ disagree slightly ○ neither disagree or agree ○ agree slightly ○ agree ○ strongly agree

37. I would not seriously consider using cloud computing.

○ strongly disagree ○ disagree ○ disagree slightly ○ neither disagree or agree ○ agree slightly ○ agree ○ strongly agree

38. I would have difficulty recommending that my superiors seriously consider using cloud computing.

○ strongly disagree ○ disagree ○ disagree slightly ○ neither disagree or agree ○ agree slightly ○ agree ○ strongly agree

39. I believe that no one should seriously consider using cloud computing.

○ strongly disagree ○ disagree ○ disagree slightly ○ neither disagree or agree ○ agree slightly ○ agree ○ strongly agree

Appendix B: Rogers Copyright Permission

SIMON & SCHUSTER

1230 Avenue of the Americas
10th Floor
New York, NY 10020
(212) 698-7260
(212) 698-7283 (fax)
agnes.fisher@simonandschuster.com

Agnes Fisher
Director
Permissions Department

February 8, 2011

Steven E. Powelson
P.O. Box 47790
Phoenix, AZ 85068-7790

Dear Mr. Powelson:

In reply to your letter of January 17th, you have our permission to use Figure 4-1, p 138 and Figure 5-1, p 170 from *Diffusion of Innovations, 5th Edition* by Everett M. Rogers, in your doctoral dissertation and in all copies to meet degree requirements at Walden University. Reapply for all subsequent uses and publication.

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Sincerely,

Appendix C: Literature Review Map

Small Business Perceptions, Innovations, and Cloud-computing

Perceptions	Small Business Knowledge, Statistics, & Understanding…	
	Small Business Economics	(Blau, 2009; Quaddus & Hofmeyer, 2007; Scupola, 2009; Rosser &Taylor, 2008; SBA, 2009)
	Small Business Descriptive	(Al-Qirim, 2007; Blau,2009; Forsman, 2008; Small Business Act, 1979; SBA, 2007 2009)
	Small Business Global Impact	(Barba-Sánchez & Martínez-Ruiz; 2009; Blau, 2009; Galston, 2010; Heffes, 2009; Li and Mitchell, 2009; Oke, Burke, & Myers, 2007; Quaddus & Hofmeyer, 2007; Rosser & Taylor, 2008; SBA, 2009; Uddin, 2006)
	Small Business Discontinuance	(Bates, 2005; Kampschroeder, Ludwig, Murray, Padmanabhan, 2008; Liao, Welsch & Moutray, 2008; Tan, Fischer, Mitchell, & Phan, 2009)
Innovation Policy	Small Business Collaboration, Intervention, & Influences…	
	Small Business Collaboration	(Allen & Stearns, 2009; Barba-Sánchez & Martínez-Ruiz, 2009; Michael & Pearce, 2009; Quaddus & Hofmeyer, 2007; Etro, 2009)
	Small Business Intervention	(ACA Arizona Commerce Authority, 2010; Clark, 2010; Cumming & Johan, 2010; Ford, Shino, Sander, & Hardin, 2008; Maine, Shapiro, & Vining, 2010)
	Small Business Academic Influenc	(Allen & Stearns, 2009; Carree & Thurik, 2008; Cervi, 2008; Estrin, 2009; Wagner, 2008)
Innovation Essentials	Small Business Innovation Essentials & Strategic Innovation…	
	Innovate or Perish	(Braganza, Awazu, & Desouza, 2009; Dibrell, Davis, & Craig, 2008; Estrin, 2009; Gúzman-Cuevas, Cáceres-Carrasco, & Soriano, 2009; Mangelsdorf, 2009; Rogers, 2003; Silverstein et al., 2009)
	Small Business Strategy	(Galán, Monje, & Zúñiga-Vicente, 2009; Ibrahim, Angelidis, Parsa, 2008; Porter, 1998; Will, 2008; Tan, Fischer, Mitchell, & Phan, 2009; Ribeiro-Soriano & Urbano 2009)
	Small Business Innovation	(Forsman, 2008; Hewitt-Dundas, 2006; Miles, 2008; Ribeiro-Soriano & Urbano, 2009; Sledgianowski, Tafti, & Kierstead, 2008; Vermeulen, Van Den Bosch, Volberda, 2007)
IT Innovations	Small Business IT and Internet Innovation Practices…	
	Small Business IT Innovations	(Al-Qirim, 2007; Archer, Wang, &Kang, 2008; Benitez-Amado, Llorens-Montes, & Perez-Arostegui, 2010; Crespell & Hansen, 2008; Oh & Pinsonneault, 2007; Qureshil, Kamal, & Wolcott, 2009; Welsh & White, 1981)
	Internet IT Innovation	(Al-Hajri & Tatnall, 2008; Cenfetelli, Benbasat, and Al-Natour, 2008; Chalhoub, 2010; Dibrell, Davis & Craig, 2008; Doherty and Terry, 2009; McAfee & Brynjolfsson, 2008; Raymond & Bergeron, 2008)
Cloud-computing Innovation	Cloud-computing Ecosystem…	
	Cloud-computing Characteristics	(Armbrust et al., 2010; Buyya, Yeo, Venugopal, Broberg, & Brandic, 2009; Cheng, 2010; Dwivedi & Mustafee, 2010; Etro, 2009; Mell & Grance, 2009, 2010; Rodero-Merino et al., 2010; Smith, 2009; Sharif, 2010; Wyld, 2009; Vescuso, 2010)
	Cloud-computing Disruptive Innovation	("Federal Govt," 2010; Brynjolfsson, Hofmann, & Jordan, 2010; Goscinski, & Brock, 2010; Han, 2010; Hayes, 2010; Katzan, 2008, 2010, Katzan & Dowling, 2008; Ford, 2010; Manzalini, Minerva, & Moiso, 2010; Ryan & Loeffler, 2010; Sahoo, 2009; Sharif, 2010;Truong, 2010; Vouk, 2008)
	Cloud-computing Commercialization	(Armbrust et al., 2010; Blaskovich, & Mintchik, 2011; Bennett, 2009; Braude, 2008; Buyya et al., 2009; Chatman, 2010; Davis, 2009; Durkee, 2010; Etro, 2009; Gens et al., 2010; Greengard & Kshetri, 2010; Lin, & Dyer, 2010;Kundra, 2010; Louridas, 2010; Rodero-Merino et al., 2010; Russell, Yoon, & Forgionne, 2010; Russolillo& Tibken, 2010; Schadler, 2009; Smith, 2009; Vouk, 2008; Wyld, 2009)

Literature Gap: Small Business Intent to Use Cloud-computing Innovation

Appendix D: Ethics and Confidentiality Disclosure Consent

Small Business Adoption of Cloud Computing

Ethics and Confidentiality Disclosure Consent

You are invited to take part in a research study of Arizona small businesses' interest in cloud-computing for improved economic value. You were chosen for the study because you are on Arizona Commerce Authority's e-mail list. This form is part of a process called "informed consent" to allow you to understand this study before deciding whether to take part.

This study is being conducted by a researcher named Steven E. Powelson, who is a doctoral student at Walden University.

Background Information:
The purpose of this study is to better understand the relationship between small business leaders' perception of its cloud-computing innovation attributes and their propensity to adopt this emerging technology. Having a better understanding of small businesses propensity to adopt cloud-computing innovations could help service providers improve positioning of this emerging technology for greater small business benefit and economic contribution.

Procedures:
If you agree to participate in this study, after answering some questions of a general nature you will be asked to take an online survey by answering 39 questions. Participation in the online survey is expected to take 15 to 18 minutes.

Voluntary Nature of the Study:
Your participation in this study is voluntary. This means that everyone will respect your decision of whether or not you want to be in the study. No one at the Arizona Commerce Authority or any other agency 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 during the study. If you feel stressed during the study you may stop at any time. You may skip any questions that you feel are too personal.

Risks and Benefits of Being in the Study:
The risks associated with participating in this study are minimal. The benefit of participating in the study survey is helping to gain further knowledge related to the research topic. Additionally, each participant will be offered the option to receive the study results.

Compensation:
No compensation is being offered for participation in the study survey.

Confidentiality:
Any information you provide will be kept entirely anonymous. The researcher will not use your information for any purposes outside of this research project. Also, the researcher will not include your name or anything else that could identify you in any reports of the study. The study data will be maintained in a safe place for a minimum of five years to protect the rights of participants.

Contacts and Questions:
You may ask any questions you have now. Or if you have questions later, you may contact the researcher via phone (602 820 4505) or e-mail (Steven.Powelson@WaldenU.edu). If you want to talk privately about your rights as a participant, you can call Dr. Leilani Endicott. She is the Walden University representative who can discuss this with you. Her phone number is 1-800-925-3368, extension 1210. Walden University's approval number for this study is 07-07-11-0160136 and it expires on July 6, 2012.

You may print this page for a copy of this form to keep.

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 clicking here, I am agreeing to the terms described above.

Appendix E: Letter of Cooperation From Arizona Commerce Authority

Arizona Commerce Authority
Contact: Brian Sherman [mailto:BrianS@AZcommerce.com]
Date

Dear Mr. Powelson,

Based on my review of your research proposal, I give permission for you to conduct the study entitled "An Examination of Small Businesses' Propensity to Adopt Cloud-Computing Innovation" with the Arizona Commerce Authority. As part of this study, I authorize you to announce your study and request participation via Arizona Commerce Authority's email publication distribution. Individuals' participation will be voluntary and at their own discretion. We reserve the right to withdraw from the study at any time if our circumstances change.

I confirm that I am authorized to approve research in this setting.

I understand that the data collected will remain entirely confidential and may not be provided to anyone outside of the research team without permission from the Walden University IRB.

Sincerely,

Brian Sherman

Innovation & Global Business Development
602.771.1118
BrianS@AZcommerce.com

Appendix F: Researcher Confidentiality Disclosure

CONFIDENTIALITY AGREEMENT

Name of Signer: Steven E. Powelson

During the course of my activity in collecting data for this research: "An Examination of Small Businesses' Propensity to Adopt Cloud-Computing Innovation" I will have access to information, which is confidential and should not be disclosed. I acknowledge that the information must remain confidential, and that improper disclosure of confidential information can be damaging to the participant.

By signing this Confidentiality Agreement I acknowledge and agree that:

1. I will not disclose or discuss any confidential information with others, including friends or family.
2. I will not in any way divulge, copy, release, sell, loan, alter or destroy any confidential information except as properly authorized.
3. I will not discuss confidential information where others can overhear the conversation. I understand that it is not acceptable to discuss confidential information even if the participant's name is not used.
4. I will not make any unauthorized transmissions, inquiries, modification or purging of confidential information.
5. I agree that my obligations under this agreement will continue after termination of the job that I will perform.
6. I understand that violation of this agreement will have legal implications.
7. I will only access or use systems or devices I'm officially authorized to access and I will not demonstrate the operation or function of systems or devices to unauthorized individuals.

Signing this document, I acknowledge that I have read the agreement and I agree to comply with all the terms and conditions stated above.

Signature: Steven E. Powelson **Date: May 16, 2011**

Appendix G: Approval to Use Survey Instrument

Steven E. Powelson

From: Frank M. Valier, DBA. [fvalier@comcast.net]
Sent: Saturday, August 14, 2010 6:23 AM
To: Powelson@revelationinc.com
Cc: McCarthy, Richard Prof.; Jay E. Aronson
Subject: Re: Requesting permission to use the survey instrument presented in "A Primary Study of Attributes of Innovations during the Prediffusion Stage" 2008

Greetings, Steven!

Thank you for your recent email requesting permission to use the survey instrument from our research on prediffusion of IT Innovations. Yes, please feel free to include that instrument in your research considerations. Also, if you have questions about the development of the instrument and modifications that we made to the original from the primary source please let me know. I would be happy to explain the history and development of this instrument.

You may have already noticed that the modified instrument that we used was based on the "original" instrument in the development of the study of attributes of innovations during the early years of attribute research (1990-1995). I think you might find my references to the development of the original instruments during that time in the article. If not, please let me know and I will send you the references from my dissertation which outline the development of the instrument in more detail.

The instrument may be a good choice for your research because it has extensively uses over the past decades and is considered reliable and valid by researchers in this area.

It would also be interesting to hear what your dissertation Chair thinks about your choice.

Also, there are a few points of discussion about early research on innovations in research and development stage of diffusion. Some of the well known Diffusion scholars are have expresses to me a lack of interest in their circles about attributes of innovations. Some claim that everything to know about them has been determined and they have moved on to other researach questions about diffusion.

I would not mind receiving a copy of your research proposal. I might perhaps be able to help point your research in a direction to make a strong contribution and assure its acceptance in some scientific publication.

We await your reply.

Best.

Frank Valier
(413) 314-0505

Appendix H: Instrument Reliability and Validity Measures

Table H1

Benchmark PreDOI Survey Instrument Reliability and Validity Measures by Variable

	Primary diffusion studies		PreDOI study	
Variable	Reliability	Validity	Reliability	Validity
Independent				
Compatibility	0.87	0.58	0.87	0.58
Complexity	0.81	-0.29	0.81	-0.27
Observability	0.73	0.39	0.73	0.36
Relative advantage	0.95	0.70	0.94	0.71
Results demonstrable	0.83	0.44	0.83	0.44
Trialability	0.84	-0.20	0.84	-0.23
Voluntariness	NA	NA	0.72	0.32
Dependent				
Intent to use	NA	NA	0.73	-0.10

Note. Reliability alpha (n=270) > 0.70 is acceptable. Validity discriminant functional coefficients: x^2 (7) = 132, $p < 0.01$. Reliability and validity data was adapted from "A Primary Study of Attributes of Innovations During the Prediffusion Stage," by F. M. Valier, R. V. McCarthy, and J. R. Aronson, 2008, *Journal of International Technology and Information Management, 17*, pp. 220-221.

Table H2

Confirmatory PreDOI Survey Instrument Reliability and Validity Measures by Variable

	Reliability statistics		
Variable	No. items	Cronbach's alpha [a]	Validity [b]
Independent			
Compatibility	4	0.83	0.58
Complexity	6	0.89	0.24
Observability	4	0.78	0.16
Relative advantage	8	0.95	0.79
Results demonstrable	5	0.93	0.15
Trialability	5	0.91	0.10
Voluntariness	4	0.93	0.09
Dependent			
Intent to use	4	0.93	0.24

[a] Reliability: alpha (n=151) > 0.70 is acceptable while > 80 desirable.
[b] Validity: discriminant functional coefficients: x^2 (7) = 203, $p < 0.01$.

Appendix I: General Participant Information Descriptive Statistics

Table I1

Participant Characteristic Descriptive Statistics by Category (Questions A-E)

Characteristic Category	Frequency	Percent	Valid percent Item	Valid percent Cumulative
A. Responsibility				
Other	2	1.3	1.3	1.3
Executive	37	24.5	24.5	25.8
Technology	19	12.6	12.6	38.4
Information technology	80	53.0	53.0	91.4
Operations	8	5.3	5.3	96.7
Finance	5	3.3	3.3	100.0
Total	151	100.0	100.0	
B. Age range				
21-30	6	4.0	4.0	4.0
31-40	49	32.5	32.7	36.7
41-50	55	36.4	36.7	73.3
51-60	35	23.2	23.3	96.7
>60	5	3.3	3.3	100.0
Valid total	150	99.3	100.0	
Missing	1	.7		
Total	151	100.0		
C. Gender				
Female	34	22.5	24.3	24.3
Male	106	70.2	75.7	100.0
Valid total	140	92.7	100.0	
Missing	11	7.3		
Total	151	100.0		

(*table continues*)

Characteristic Category	Frequency	Percent	Valid percent	
			Item	Cumulative
D. Education				
High school	2	1.3	1.3	1.3
Some college	9	6.0	6.0	7.3
Bachelor	98	64.9	65.3	72.7
Master	39	25.8	26.0	98.7
Doctorate	2	1.3	1.3	100.0
Valid total	150	99.3	100.0	
Missing	1	.7		
Total	151	100.0		
E. Work years				
1-10	19	12.6	12.6	12.6
11-20	73	48.3	48.3	60.9
21-30	48	31.8	31.8	92.7
31-40	8	5.3	5.3	98.0
>40	3	2.0	2.0	100.0
Total	151	100.0	100.0	

Table I2

Small Business Attributes Descriptive Statistics by Category (Questions F-K)

Attribute Category	Frequency	Percent	Valid percent Item	 Cumulative
F. Legal structure				
Proprietorship	16	10.6	10.7	10.7
Partnership	17	11.3	11.3	22.0
LLC	46	30.5	30.7	52.7
Corporation	71	47.0	47.3	100.0
Valid total	150	99.3	100.0	
Missing	1	.7		
Total	151	100.0		
G. Number employees				
0-9	43	28.5	28.5	28.5
10-49	82	54.3	54.3	82.8
50-249	23	15.2	15.2	98.0
250-499	3	2.0	2.0	100.0
Total	151	100.0	100.0	
H. Years in business				
<6	11	7.3	7.4	7.4
6-10	37	24.5	24.8	32.2
11-20	62	41.1	41.6	73.8
21-30	37	24.5	24.8	98.7
>30	2	1.3	1.3	100.0
Valid total	149	98.7	100.0	
Missing	2	1.3		
Total	151	100.0		
I. Annual revenue				
<$2Millon	87	57.6	57.6	57.6
$2-3Million	59	39.1	39.1	96.7
$11-50Million	5	3.3	3.3	100.0
Total	151	100.0	100.0	

(*table continues*)

Attribute Category	Frequency	Percent	Valid percent Item	 Cumulative
J. Industry				
Agri., forest, fish & hunt	2	1.3	1.3	1.3
Construction	5	3.3	3.4	4.7
Education	12	7.9	8.1	12.8
Finance and insurance	25	16.6	16.8	29.5
Heath care	22	14.6	14.8	44.3
Information technology	13	8.6	8.7	53.0
Manage companies	3	2.0	2.0	55.0
Manufacturing	19	12.6	12.8	67.8
Prof., science, & tech.	38	25.2	25.5	93.3
Real Estate	3	2.0	2.0	95.3
Transport & warehouse	4	2.6	2.7	98.0
Other	3	2.0	2.0	100.0
Valid total	149	98.7	100.0	
Missing	2	1.3		
Total	151	100.0		
K. Type cloud computing used [a]				
SaaS	14	9.3	9.3	9.3
IaaS	1	.7	.7	10.0
PaaS	1	.7	.7	10.7
Other	18	11.9	12.0	22.7
None	124	82.1	82.7	105.4
Valid total	150	99.3	100	
Missing	1	.7		
Total	151	100.0		

[a] More than one type of cloud computing used may have been indicated.

Table I3

Cloud-Computing Awareness Descriptive Statistics by Category (Questions L-P)

Extent of awareness Category	Frequency	Percent	Valid percent Item	 Cumulative
L. Years known about cloud computing				
<1	38	25.2	25.5	25.5
1-3	83	55.0	55.7	81.2
4-6	28	18.5	18.8	100.0
Valid total	149	98.7	100.0	
Missing	2	1.3		
Total	151	100.0		
M. Attended cloud computing presentations				
Yes	35	23.2	23.8	23.8
No	112	74.2	76.2	100.0
Valid total	147	97.4	100.0	
Missing	4	2.6		
Total	151	100.0		
N. Read cloud computing advertisement				
Yes	124	82.1	82.1	82.1
No	27	17.9	17.9	100.0
Total	151	100.0	100.0	
O. Talked to colleagues about cloud computing				
Yes	109	72.2	72.7	72.7
No	41	27.2	27.3	100.0
Valid total	150	99.3	100.0	
Missing	1	.7		
Total	151	100.0		
P. Previously used cloud computing				
Yes	31	20.5	20.9	20.9
No	117	77.5	79.1	100.0
Valid total	148	98.0	100.0	
Missing	3	2.0		
Total	151	100.0		

Appendix J: Study Variable Descriptive Statistics

Table J1

Study Questions Descriptive Statistics Within Study Variable

Variable Question [a]	Range				
	Min.	Max.	Mean	Std. deviation	Variance
Compatibility					
Q01	1	7	4.04	1.685	2.838
Q02	2	7	6.05	1.012	1.024
Q03	1	7	4.64	1.602	2.566
Q04	2	7	6.27	1.019	1.039
Complexity					
Q05	1	6	3.38	1.531	2.343
Q06	1	7	3.83	1.691	2.859
Q07	1	6	3.57	1.314	1.727
Q08	1	7	2.39	1.460	2.133
Q09	1	6	2.95	1.507	2.271
Q10	1	7	2.80	1.740	3.027
Observability					
Q11	1	7	4.63	1.992	3.968
Q12	1	7	2.01	1.492	2.226
Q13	1	7	2.00	1.447	2.093
Q14	1	7	4.04	1.758	3.092
Relative advantage					
Q15	1	7	5.26	1.253	1.569
Q16	1	7	5.09	1.293	1.671
Q17	1	7	5.68	1.085	1.178
Q18	2	7	5.93	1.063	1.129
Q19	2	7	5.91	1.104	1.218
Q20	1	7	6.08	1.140	1.300
Q21	1	7	5.31	1.434	2.056
Q22	1	7	6.05	1.145	1.311

[a] $n = 151$

(*table continues*)

Variable Question [a]	Range		Mean	Std. deviation	Variance
	Min.	Max.			
Results demonstrable					
Q23	1	7	5.64	1.480	2.191
Q24	2	7	5.70	1.385	1.917
Q25	2	7	5.74	1.253	1.569
Q26	1	7	5.60	1.592	2.536
Trialability					
Q27	1	7	4.05	1.874	3.511
Q28	1	7	3.36	1.675	2.805
Q29	1	7	4.25	1.755	3.080
Q30	1	7	3.98	1.577	2.486
Q31	1	7	4.66	1.693	2.867
Voluntariness					
Q32	1	7	5.03	1.908	3.639
Q33	1	7	5.95	1.498	2.245
Q34	1	7	5.97	1.671	2.792
Q35	1	7	6.15	1.710	2.925
Intent to use					
Q36	1	7	5.59	1.457	2.124
Q37	1	7	5.46	1.557	2.423
Q38	1	7	5.28	1.642	2.695
Q39	2	7	6.23	.905	.819

[a] $n = 151$

Table J2

Study Variable Central Tendency and Dispersion Statistics Within Type Based on Completed Survey Dataset

Type Variable [a]	Range				
	Min.	Max.	Mean	Std. deviation	Variance
Independent variables					
Compatibility	2.000	7.000	5.2500	1.08243553	1.172
Complexity	1.000	6.333	3.1545	1.24945904	1.561
Observability	1.000	7.000	3.1705	1.28852980	1.660
Relative advantage	1.375	7.000	5.6647	1.02269771	1.046
Results demonstrable	1.400	7.000	5.6636	1.32752820	1.762
Trialability	1.000	7.000	4.0569	1.48132868	2.194
Voluntariness	1.000	7.000	5.7732	1.53795075	2.365
Dependent variable					
Intent to use	1.500	7.000	5.6391	1.27692200	1.631

[a] n = 151

Table J3

Study Variable Distribution Statistics Within Type Based on Completed Survey Dataset

Type Variable [a]	Skewness [b]	Kurtosis [c]
Independent variables		
Compatibility	-.625	.035
Complexity	.535	-.602
Observability	.602	.157
Relative advantage	-1.758	3.747
Results demonstrable	-1.294	.774
Trialability	.139	-1.046
Voluntariness	-1.889	2.668
Dependent variable		
Intent to use	-1.243	.713

[a] n = 151. [b] Standard error = .197. [c] Standard error = .392.

Table J4

Study Variable Central Tendency and Dispersion Statistics Within Type Based on Normalized Dataset

Type Variable [a]	Range				
	Min.	Max.	Mean	Std. deviation	Variance
Independent variables					
Compatibility	4.000	6.750	5.41860	.86978856	.757
Complexity	1.000	5.333	2.7713	.98983279	.980
Observability	1.250	6.000	3.1047	1.06167537	1.127
Relative advantage	4.500	7.000	5.9811	.53499500	.286
Results demonstrable	5.000	7.000	6.2302	.56278086	.317
Trialability	1.000	7.000	4.3512	1.45065861	2.104
Voluntariness	5.000	7.000	6.3052	.50932649	.259
Dependent variable					
Intent to use	4.750	7.000	6.1599	.61466489	.378

[a] $n = 86$

Table J5

Study Variable Distribution Statistics Within Type Based on Normalized Dataset

Type Variable [a]	Skewness [b]	Kurtosis [c]
Independent variables		
Compatibility	-.096	-1.396
Complexity	.732	.090
Observability	.064	-.357
Relative advantage	-.463	-.288
Results demonstrable	-.437	-.472
Trialability	-.110	-.805
Voluntariness	-.307	-.462
Dependent variable		
Intent to use	-.461	-.668

[a] $n = 86$. [b] Standard error = .260. [c] Standard error = .514.

Appendix K: Linear Regression Results

Table K1

Bivariate Linear Regression Coefficients for Independent Variables and Intent to Use

Independent variable [a]	Constant	Unstandardized coefficients		Standardized coefficients	T	Sig.	95.0% CI for B	
		B	Std. Error	Beta			Lower	Upper
Compatibility	4.628	.283	.071	.400	4.001	.000	.142	.423
Complexity	6.864	-.254	.062	-.409	-4.107	.000	-.377	-.131
Observability	5.828	.107	.062	.185	1.723	.000	.016	.230
Relative advantage	3.253	.486	.114	.423	4.278	.000	.260	.712
Results demonstrable	4.706	.233	.116	.214	2.005	.048	.002	.465
Trialability	5.625	.123	.044	.290	2.776	.007	.035	.211
Voluntariness	6.216	-.009	.132	-.007	-.068	.946	-.271	.253

[a] Dependent variable: Intent to use

Table K2

Bivariate Linear Regression Model Summary Results for Independent Variables and Intent to Use

Independent variable [a]	R	R square	Change statistics [b]		Durbin-Watson
			F change	Sig. F chg.	
Compatibility	.400	.160	16.009	.000	1.868
Complexity	.409	.167	16.866	.000	2.090
Observability	.185	.034	2.969	.089	2.090
Relative advantage	.423	.179	18.301	.000	2.177
Results demonstrable	.214	.046	4.021	.048	2.097
Trialability	.290	.084	7.707	.007	2.008
Voluntariness	.007	.000	.005	.946	2.065

[a] Dependent variable: Intent to use. [b] df1 = 1; df2 = 84

Table K3

Multiple Regression Coefficients for Independent Variables and Intent to Use

Independent variable [a]	Unstandardized coefficients B	Unstandardized coefficients Std. Error	Standardized coefficients Beta	T	Sig.	95.0% CI for B Lower	95.0% CI for B Upper
(Constant)	2.971	1.074		2.766	.007	.835	5.108
Relative advantage	.490	.115	.426	4.268	.000	.262	.718
Voluntariness	.041	.121	.034	.341	.734	-.199	.281

[a] Dependent variable: Intent to use

Table K4

Multiple Regression Correlations for Independent Variables and Intent to Use

Independent variable [a]	Correlations Zero-order	Correlations Partial	Correlations Part
Relative advantage	.423*	.424*	.424*
Voluntariness	-.007	.037	.034

[a] Dependent variable: Intent to use
* $p < .01$

Table K5

Multiple Regression Summary Relative Advantage and Voluntariness With Intent to Use

Independent variables [b]	R	R Square	Change statistics [b] F change	Change statistics [b] Sig. F chg.	Durbin-Watson
Relative advantage, Voluntariness	.424	.180	9.112	.000	2.169

[a] Dependent variable: Intent to use. [b] df1 = 2; df2 = 83

Curriculum Vitae

Steven E. Powelson

Academic Background:

- Master Business Administration: Leadership and Innovation
  - Grand Canyon University, Phoenix, AZ
- Bachelor Science: Computer Information Systems
  - Arizona State University, Phoenix, AZ
- AAS Computer Science: Programmer/Analyst
  - Pima Community College, Tucson, AZ

Academic/Teaching Experience:

- Information Systems & Technology: University of Phoenix (online faculty)
- Computer Programming: Pima Community College, Tucson, AZ

Technical and Specialized Skills

- IT Strategy Facilitation and Change Leadership
- Six Sigma: Practitioner and Trainer
- Situational Leadership II®: Partnering, Teams, and Organizations
- Project Management Professional
- Database Architect (Relational and Multidimensional)

Professional Experience

- Revelation Data Systems, 1987-Present
  - Founder and CEO - Consultant/Collaborator: IT Strategic Management, Information Technology Services, and Project Management
- Revelation Finance, Inc., 1985-Present
  - Founder and CEO - Equity Investment Portfolio Financing

Nonprofit Service

- BridgeBuilders Int'l Leadership Network, 1999-Present
  - Board Chairperson since 2000
  - ECFA delegate representative
- Family Life Communications, Inc., 1998-2003
  - Board Executive Committee 5-year term
  - Finance and Compensation Committee Chairperson 4-year term
  - Audit Committee 1-year term

Research and Scholarly Activities

- NPO Strategy Mapping (White Paper), 2007
- RADR (Results, Advancement, Development, and Recognition), 2006
- Collaborating Director KMA Software Consortium, 1999-2000
- The Millennium passage . . . whY 2 Konfused?, 1999