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Employee Acceptance of Employer Control Over Personal Devices

Kevin Callies

Employee Acceptance of Employer Control Over Personal Devices

By

Kevin R. Callies

Dissertation Committee:

Dr. Cherie Noteboom

Dr. Daniel Talley

Dr. Yong Wang

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DISSERTATION APPROVAL FORM

This dissertation is approved as a credible and independent investigation by a candidate for the Doctor of Philosophy in Information Systems degree and is acceptable for meeting the dissertation requirements for this degree. Acceptance of this dissertation does not imply that the conclusions reached by the candidate are necessarily the conclusions of the major department or university.

Student Name: Kevin Callies

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Dissertation Chair: Cheri Toteboom Date: 4-22-2019

Committee member: David A Tegg Date: 4/23/19

Committee member: Yiwang Date: 04/22/2019

Committee member: _____ Date: _____

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Abstract

Organizations face new and growing security challenges as consumer technology continues to be integrated into organizational workflows. Bring your own device (BYOD) is a phenomenon that is here to stay; however, securing employee's personally owned devices may require the organizations to consider exerting some control over the employee's device. In order for organizations to secure access to their sensitive information in this way, they must first garner the employee's consent. This research seeks to examine employee acceptance of employer control by constructing a model of employee acceptance based upon the extant acceptance literature. The model is then empirically tested through the use of structural equation modeling. The results indicated that social influence and to a lesser extent habit play a crucial role in employee's desire to accept employer control over personally owned devices. Supporting these two significant factors can help technology managers secure employee acceptance of employer control over personally owned devices.

Introduction

Employees are increasingly demanding to be allowed to use their own personal devices, or other consumer technology, for work related tasks even if it goes against an organization's current security policy (Dillow, 2013; Eddy, 2013). When companies allow employees to use personal devices for work related tasks it is typically referred to as Bring Your Own Device or BYOD for short. The use of personal devices for work activities opens up a whole new arena of security and privacy concerns (Miller, Voas, & Hurlburt, 2012). Several solutions have been proposed for the organizational concern of privacy, including exerting some control over the employee's privately-owned device (French, Guo, & Shim, 2014). These solutions include employees installing special applications or device management software to maintain control over the organization's sensitive data.

A key aspect of this security paradigm is the employee's consent. The primary focus of this research is how to secure employee acceptance of employer control over personal devices, specifically by modeling employee acceptance. This research proposes to adapt the Unified Theory of Acceptance and Use of Technology (UTAUT) and its extension as a model for employee acceptance of employer control over their personally owned devices. Once a model of employee acceptance has been developed, it is empirically tested by first administering a survey

to employees to gather data, and then applying structural equation modeling to test each antecedent's effect on an employee's acceptance intentions.

Research Question

This research seeks to identify the antecedents of employee acceptance of employer control over personally owned devices. The primary objective is to model employee acceptance using the extant technology acceptance theories and test this model to determine which factors are relevant to employee acceptance of control. This model can be quantitatively examined to determine if the constructs proposed in the relevant technology acceptance literature apply in this instance. While the prior research into technology acceptance provides an appropriate starting point for the development of a model of employee acceptance, it has not been applied or empirically tested in the same manner as suggested by this research. In the end there are two primary goals for this research. First, this research seeks to examine the factors that support employee acceptance of employer control over personally owned devices. Second, this research seeks to expand the technology acceptance literature into a new domain and provide empirical evidence to support its application in such a context.

This research has practical applications for managers, developers, and employees. Managers and employees can design effective policies and procedures for securing BYOD taking into account the preferences of employees. By supporting the significant antecedents of employee acceptance, managers can ensure that they have the best environment for fostering BYOD security policy compliance. Similarly, employees can request additional support or assistance from their employer in order to best tolerate employer control. Lastly, security software developers can focus on security paradigms that best support employees' and employers' desires. Peripherally, other researchers may also benefit from the findings of this research as it applies prior technology acceptance research into a new area of acceptance. This research extends and quantitatively tests a model based on the extant technology acceptance literature. As such future technology acceptance research can benefit from the insights gathered by this research when selecting variables or testing future acceptance models, specifically future models and research involving the acceptance of employer control.

Literature Review

Definitions

Traditionally, upper management and information technology (IT) departments have dictated the technology resources that would be acquired and utilized by the organization's employees, but the impressive growth in mobile computing, in both capability and connectivity, has led to a rise in employee desire to use a whole new host of computing devices for work related activities. The application of what is typically considered consumer grade technology for business related activities is generally termed the consumerization of IT (CIT) (D'Arcy, 2011). CIT encompasses a wide range of changes happening in organizational IT and can have multiple definitions and implementations depending on the position or perspective of the affected party (Harris, Ives, & Junglas, 2012).

From the employee's viewpoint CIT means the incorporation of consumer technology in the workplace; or, the everyday application, for work purposes, of tools and technology that are typically used outside of the work environment. Employees are familiar with this technology as they use it regularly for personal activities, and this familiarity readily transfers to enterprise applications. From the organizational perspective CIT is represented by the application of a large number of marginally approved consumer grade technology and devices for organizational activities. Meaning, enterprise IT departments must contend with employees brining in a large number of devices, software, and services, of which they are familiar from personal use, into the organization's technology environment. Last, the market or providers of technology view CIT as the blurring of the line between consumer and enterprise technology. Technology is quickly losing its separation between consumer and enterprise technology. Technology intended to be used by the consumer may quickly be adopted by larger organizations. Providers of technology must adapt to this new paradigm and recognize that consumer and enterprise software are quickly converging.

There are many avenues through which CIT is beginning to impact the corporate environment, and management can use a variety of approaches to support or curtail the adoption of consumer technology into their organizations. Each approach has its own level of consumer grade technology integration and associated security concerns. The most traditional approach is where management provides employees with the consumer technology they should use. This is sometimes called the here is your own device (HYOD) or authoritarian approach (Ghosh, Gajar,

& Rai, 2013; Harris et al., 2012). This approach is very similar to prior management of IT but does begin the process of incorporating consumer grade technology into the organization. A slightly less restrictive approach allows employees to choose their own device, known as choose your own device (CYOD). In this strategy, the organization provides a list of devices from which the user may select (French et al., 2014; Ghosh et al., 2013). In this middle ground approach, the chosen device is still typically owned and controlled by the organization.

The least restrictive approach towards CIT is where employees use personally owned devices for work. This approach is also known as bring your own device (BYOD) which is an apt description as employees are actively choosing, purchasing, and utilizing their own technology to accomplish their assigned responsibilities (Gens, Levitas, & Sega, 2011). This method grants the employee the most control but introduces the largest variety of technology into the organization. Additionally, this approach presents a number of problems for IT managers and IT employees (Cosgrove & Brooks, 2013) including supporting a wide variety of devices and presenting the largest security risk.

The prospect of utilizing personally owned devices for enterprise level tasks is an evolution in the way organizations handle IT. It is the primary focus of this research, but it is only one part of the entire CIT concept. Many organizations are beginning to see the rise in bring your own software (BYOS) and bring your own applications (BYOA) which is a trend supported by the employees using their own devices (Eschelbeck & Schwartzberg, 2012; French et al., 2014; Storey, 2017). Employees are familiar with traditionally consumer grade software and services and are beginning to bring them into the corporate environment. Service technologies introduced as consumer products, such as Dropbox and Facebook, are being used by employees to collaborate and communicate (King, 2012). CIT is on the rise and brings with it a number of advantages; however, it is not without its concerns. Primarily the security of the employer's information and the privacy of the user's personal information.

Driver and Advantages

There are several enabling conditions that are pushing employees and organizations to adopt consumer technology to the enterprise environment. The primary drivers for this phenomenon is the unprecedented number of mobile devices, the increased capabilities of said devices, and the availability of constant network connectivity (Ortbach, Koeffer, Bode, &

Niehaves, 2013). Employees and employers hope to reap several rewards for moving towards CIT such as increased connectivity and innovation. While smartphones and tablets are currently the leading BYOD targets, laptops and PCs could be on the horizon.

The recent uptick in CIT is due mostly to the devices themselves. Firstly, personally owned devices, smartphones and tablets, are commonplace in the hands of an organization's employees, and they are happier using their own familiar devices (French et al., 2014). A survey completed by Forrester found that over a third of employees will acquire and use new technical devices even before their employing organizations begin to quantify the possible uses (Gray, Kane, Whiteley, & Crumb, 2011). Since employees have the technology, they will naturally want to use them for business purposes; whether these activities are simply checking email or more advanced activities such as collaboration and notifications. The fact that technology is abundant and that employees want to be able to use them for business purposes means that BYOD is here and advancing (French et al., 2014). The second driver of BYOD is the increasing capabilities of smartphones and tablets (Eschelbeck & Schwartzberg, 2012; Ghosh et al., 2013). Common differences between technology for business use and personal use are evaporating. Electronic devices with capabilities paralleling or surpassing business technology are available at mass market prices. The elimination of separate technology for work and for personal use has increased the demand for business use of personal devices. The last major contributing factor for the rise of BYOD is the increase in connectivity and the availability of communication networks (Eschelbeck & Schwartzberg, 2012; Kulkarni et al., 2014). An employee can be constantly connected to the Internet through wireless and cellular networks. This grants employees the opportunity to check in on tasks or emails during any available downtime.

These three factors are not the only enabling conditions for BYOD, but they are the primary driving factors from the employee’s perspective. In general, people are more connected to technology than ever, so it is natural that this trend would expand into their employment activities (Gens et al., 2011). People regularly use hardware and software solutions for their own personal use. When employees encounter an issue that they know can be solved via personal technology, they naturally want to incorporate the technology into their work environment. Meaning, enterprise use of personal devices is a natural expansion of how technology is currently being used.

With employees desiring access to business related resources through their personally owned technology, IT managers can rightly ask if there are any benefits to BYOD. There are several benefits for the organization, some of which can be immediately realized and others that might not be readily apparent. The most prevalent benefits are increased employee satisfaction, productivity, and collaboration. Additionally, some organizations are choosing BYOD with the desire to decrease technology procurement costs (Boon & Sulaiman, 2015; French et al., 2014).

The increases in productivity and collaboration come primarily from the increased employee satisfaction and connectedness that BYOD affords. Employees regularly have their personal devices at arm's length, so it is a small step for employees to connect and collaborate when between large tasks or outside of the regular office environment (Gens et al., 2011). A quick email can answer a question and continue work elsewhere or prevent a problem from escalating. Employees can also share documents or ideas from anywhere using email or a variety of commercially available applications such as Dropbox, Google Docs, or even Facebook (Debeasi et al., 2012). The close proximity of technology and the ability for employees to rapidly respond supports an environment of productivity and collaboration. Employee satisfaction is regularly listed as the top benefit from BYOD with many organizations listing it as their primary gain from BYOD (Willis, 2013). Employees are happier when they are using their own familiar device.

Although not all organizations may reap reduced cost from BYOD, some organizations do find savings in not having to purchase expensive devices or having to support their use (Ghosh et al., 2013). The employees purchase their own device and sometimes share the cost with the organization via a stipend or allowance. The employee would likely purchase a device anyway, and the organization does not have to pay the complete cost for acquiring the technology. A decrease in support costs comes from the employee managing and learning how to use their own device rather than requiring support and training from internal IT (Cosgrove & Brooks, 2013).

Additionally, organizational IT managers may find that BYOD allows for increases the adoption of new technologies (Willis, 2012). Employees are able to experiment and bring in new solutions that they have previously applied in their personal lives. This also means that the organization can reduce its involvement in secondary or peripheral technology procurement. The employees can experiment with new technology allowing the organization to focus on strategic

technologies (Willis, 2012). However, even for organizations the primary benefit of BYOD is the increased employee satisfaction and collaboration it provides.

Issues and Security

While there are many enabling factors and potential benefits of BYOD, there are several concerns that need to be addressed by the organization's managers and employees. These issues include: personal privacy, data ownership, work-life balance, and security. Security is frequently labeled as the most pressing issue facing organizations when considering BYOD (Forrester Research, 2012). The primary security concern for organizations is the protection of their IT integrity and private information; however, the personal ownership of the device greatly complicates the protection of sensitive information and potentially limits what countermeasures an organization may employ. Additionally, there are a number of threats that are enhanced due to the nature of BYOD.

Although many of the challenges facing BYOD are not new, they bring with them many additional considerations and caveats mostly due to the size and ownership of the device. Any device that is introduced into an enterprise network has the potential to bring malware, so the large number of unregulated devices that BYOD presents a unique risk to organizations (Ghosh et al., 2013; Miller et al., 2012). Malware could quickly spread from the employee's personal device to the organization's sensitive technology resources. The size and ubiquity of the devices means employees can more frequently place the organization at risk. Since the employee owns the device it is harder for the organizations to ensure proper protections and countermeasures are utilized.

CIT predominantly encompasses mobile technology which is inherently more vulnerable to being lost or stolen especially when the device is owned by the employee (Ghosh et al., 2013). This is due to the employee having their personal devices with them at all times, which means the device has a greater chance of being left behind or taken by nefarious individuals. Lost and stolen devices is not a novel problem facing organizations as many of these same issues were introduced when laptops became commonplace. However, in the context of BYOD, the devices are owned by the employee, smaller, and brought by the employee nearly everywhere they go making them much more vulnerable than laptops (Miller et al., 2012). The loss or theft of BYOD technology is of concern to the organization as devices used for work may contain the

organization's sensitive information, and since these devices are owned by the employee, they are less likely to be centrally managed and controlled by a dedicated IT department. Meaning, personally owned devices are much less likely to apply and follow the organization's security policies (Miller et al., 2012). Organizations use security policies to protect themselves against potential security risks. Therefore, personally owned devices present a unique challenge for IT security.

In order to secure their information in an environment allowing for the use of personally owned devices, organizations have two fundamental alternatives: virtualization or mobile device management (MDM) (French et al., 2014; Scarfo, 2012). This boils down to either hands-off, where sensitive information is never stored on the device and only delivered temporarily through the network; or hands-on, where the organization must exert some control over the employee's device. Virtualization is used to ensure that no data is permanently stored on the user's personal device (Debeasi et al., 2012). With virtual applications, the network is used to deliver business information on demand. This prevents proprietary data from persisting on the user's device but requires good user authentication and lots of network and data usage (Debeasi et al., 2012). MDM works in much the same way as traditional technology management where the organization enforces specific security policies on the devices (Scarfo, 2012). These policies can include anything the organization feels is necessary to ensure security such as enforced authentication, encryption, limited permissions, and even the ability to remotely wipe the device. This process typically requires an MDM agent to be installed on the personally owned device (Eslahi, Naseri, Hashim, Tahir, & Saad, 2014). The MDM agent communicates with a centrally controlled management system that enforces security and policy compliance on the user's mobile devices. MDM has the distinct benefit of less network dependence and may therefore provide a better user experience (Debeasi et al., 2012). Since, the MDM framework requires the user's device to have some sort of client application installed on their personal device the employer must exert some control over the employee's personal device. Accordingly, the employee must consent to their employer's wishes if they wish to participate in the organization's BYOD paradigm.

MDM is a strong contender when it comes to BYOD security and central to the question this research seeks to answer. The factors that determines an employee's willingness to accept and employer's control can greatly influence the security which the organization may wish to

employ. MDM affords an organization greater control over how their data is protected and allows employees to have access to more immersive and powerful native applications. However, the employee must allow the organization to install their particular MDM client on their personal device. This means that the employer must be granted consent and needs to be cognizant of the factors that support employee acceptance.

Technology Acceptance

CIT and by extension BYOD is here to stay and appears to be on the rise (Eddy, 2013); therefore, organizations must address the security and privacy concerns that accompany BYOD. Author Scarfo summarized the BYOD security approaches as "…two opposite approaches: hands-off devices versus hands on-devices." (2012, p. 451). There are certain benefits to a hand-on approach to BYOD security such as quicker response times and less network dependence; additionally, end users tend to prefer native applications (Abed, 2016; Forrester, 2015). This means that one of the two major approaches to security in BYOD requires the employer to apply some control over the employee's device. However, employees must consent to the hands-on approach as the organization will need access to their personal devices in order to install the device management applications. Employee consent to employer control of their personal devices has yet to be fully researched, but there are several IT behavior models that can be used as the theoretical background for predicting employee behavior.

The extant research has developed and applied several theoretical models to explain technology acceptance. The models include the theory of reasoned action, the technology acceptance model, and the unified theory of acceptance. These models have primarily used an employee's intention as the independent variable with several hypothesized constructs serving as antecedents to acceptance. The underlying antecedents of technology acceptance have provided researchers with a range of constructs to use as dependent variables. These constructs have been found to have fairly consistent explanatory power across the existing research and have been used as a starting point for the acceptance of a plethora of technology-related behaviors including policy acceptance (Storey, 2017) and BYOD acceptance (Loose, Weeger, & Gewald, 2013). However, the extant research has yet to examine the acceptance of employer control as presented in this research.

These theories tend to examine an individual's technology acceptance behavior as indicated by their intentions. This necessarily assumes that the individual is a rational actor and is inclined to follow through with their intentions (Loose et al., 2013). This is primarily derived from the social theory on which much of the technology acceptance literature has been built. Meaning, intention is considered the primary predictor of an individual's action. The theory is known as the theory of reasoned action (TRA), shown in figure one, and posits the important theoretical link between intention to comply and actual intent, which has facilitated much of the current acceptance research. TRA has seen multiple empirical evaluations and extensions but remains fairly consistent in its use and explanatory power (Madden, Ellen, & Ajzen, 1992). By studying the intention to comply with technology, researchers have been able to circumvent analyzing employee's actual acceptance behavior. The issue with analyzing actual behavior is it is terribly difficult to measure. Additionally, employees may be reluctant to disclose actual behavior or exaggerate their compliance for fear of repercussions from their employer. Within acceptance research, intention to comply, is often used as a substitute for actual behavior as it is easier to operationalize and quantify.

Besides the relationship between intentions and actual behavior, the TRA has also provided two other highly studied constructs: attitude and normative beliefs. Attitude is the employee's feeling towards the behavior and is fairly straight forward. Normative beliefs, sometimes termed subjective norm (Sommestad et al., 2014), is a construct that attempts to capture the individual's perceived social pressures to conform. Simply put, normative beliefs attempts to capture what an individual thinks their colleagues and coworkers think about the desired action. This construct is fairly analogous to peer pressure, in that, if an individual believes that their peers will comply with policy, they are more likely to comply.

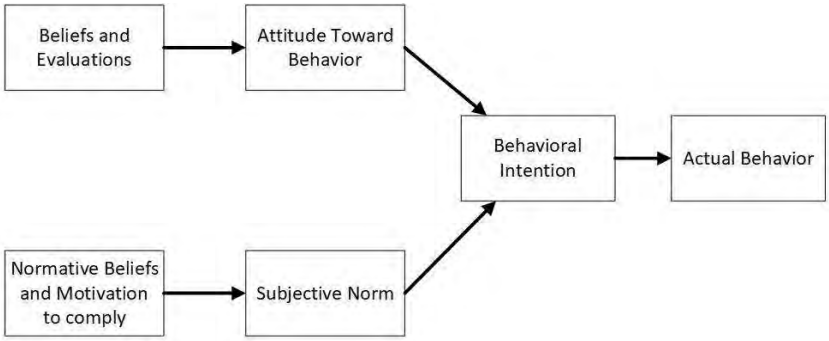


Figure 1 Theory of Reasoned Action (TRA). Adapted from Davis, Bagozzi, and Warshaw (1989).

One of the first models that directly adapts TRA into the context of technology acceptance is shown in figure two. This model is known as the technology acceptance model (TAM) (Davis et al., 1989). This model has been very influential in the technology acceptance literature and directly built upon TRA. TAM has been extensively used to examine user acceptance of technology and has been shown to explain a fair amount of variance (Venkatesh & Davis, 2000). Similar to TRA, this model proposes several antecedents that determines an individual's intention but is confined to the acceptance of a particular technology or technological solution. An individual's intention is theorized by TAM, and the theory on which its based, to predict the individual's actual behavior. In TAM behavioral intention to use is directly influenced by attitude and perceived usefulness (Davis et al., 1989). Attitude and perceived usefulness are subsequently theorized to be directly determined by perceived ease of use. While attitude is also affected by perceived usefulness.

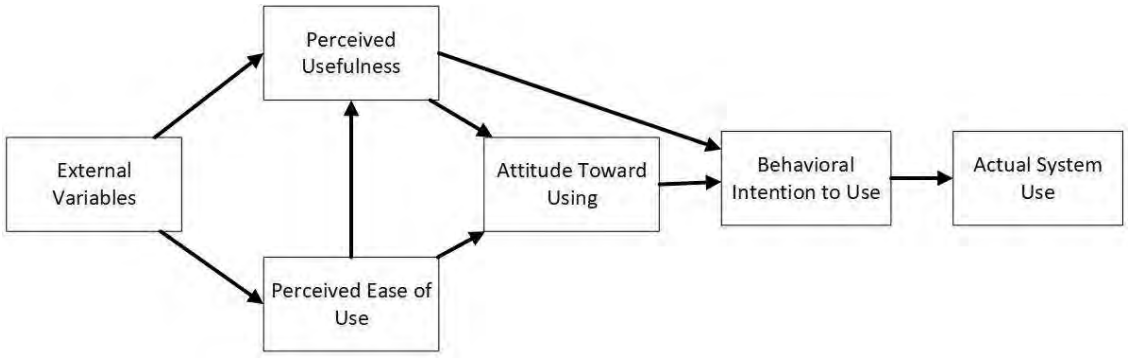


Figure 2 Technology Acceptance Model (TAM). Adapted from Davis, Bagozzi, and Warshaw (1989).

While the attitude construct remains unchanged from that found in the TRA, perceived usefulness and perceived ease of use are additional constructs not present in the more general TRA model of behavior. Additionally, the subjective norm construct has been removed. Perceived usefulness and perceived ease of use are defined as a user's subjective view on how useful a technology will be in accomplishing their organizational job and how hard the technology will be to use and integrate into their organizational activities, respectively (Davis et al., 1989). The subjective norm construct, defined as social pressure to conform, was dropped by the authors of TAM because of the its nebulous and uncertain nature (Davis et al., 1989).

TAM has been demonstrated to provide a fair amount of explanatory power when modeling user acceptance of technology (Venkatesh & Davis, 2000) but was extended by one of its primary authors. The extended model, termed TAM2 and shown in figure three, is a direct evolution of the model on which its based and contains the whole TAM model within (Venkatesh & Davis, 2000). This model of technology acceptance introduces six additional variables and also reintroduces subjective norm.

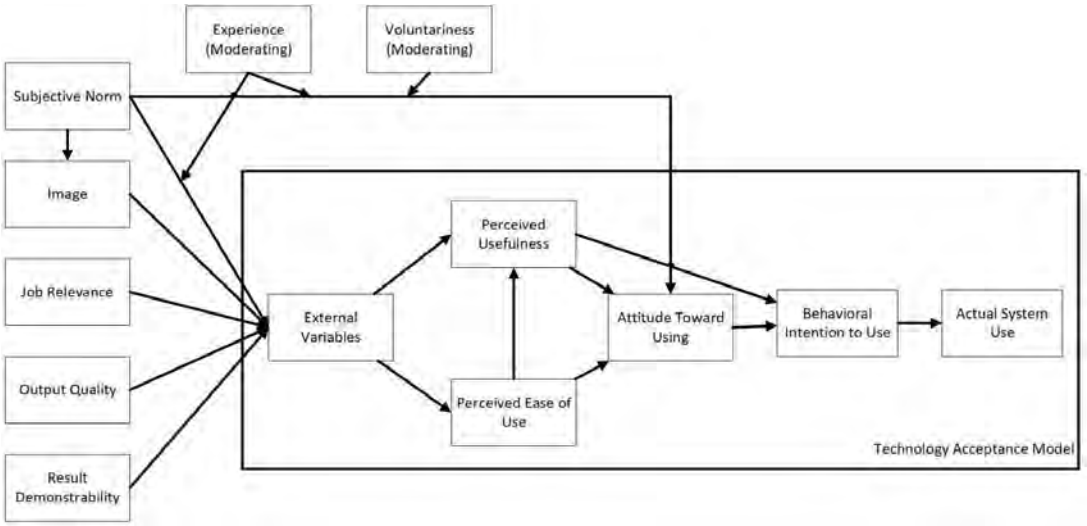


Figure 3 Technology Acceptance Model 2 (TAM2). Adapted from Venkatesh and Davis (2000).

TAM2 differs from TAM in that five new antecedents are proposed for perceived usefulness and two new variables are theorized to mediate these relationships. The additional antecedents include: subjective norm, image, job relevance, output quality, and result demonstrability, while experience and voluntariness are hypothesized to mediate the effects of subjective norm. Subjective norm remains similarly defined as it was previously in that it is analogous to social pressure to use a particular technology, but is also theorized to influence an individual's perceived usefulness, usage intention, and the newly introduced image antecedent. The image construct is directly related to the subjective norm construct as image is the degree to which the individual believes their social status or image will be enhanced by using the new technology. The other antecedents, job relevance, output quality, and result demonstrability, are thought to influence only perceived usefulness. These three constructs are indirectly related in that they, overall, represent an individual's ability to perform their organizational assignments.

Job relevance is relatively straightforward as a construct as it is defined as the relevance of a new technology on an individual's ability to complete their assigned job. How the user believes that the new technology will output, regardless of whether or not said outputs are related to their particular tasks, is considered output quality. TAM2 proposes that a system that is viewed to have outstanding outputs is more likely to be accepted by its potential users. The final antecedent proposed by TAM2 is results demonstrability. This concept attempts to capture the user's ability to see the effects of the new system on their performance. If the introduced technology's influence is obfuscated or not directly observable by the user, they may be inclined to attribute its effects to other systems or changes thus negatively impacting their acceptance of the new technology. Voluntariness and experience complete the additional constructs introduced by TAM2. Voluntariness is the degree to which the user feels that the new technology is optional and moderates the relationship between subjective norm and intention to use. The final construct of TAM2 is experience and is the level of familiarity a user has with the new technology. This variable moderates the relationships subjective norm between perceived usefulness and intention to use. Meaning, the more experienced a user is with a system the less impact subjective norm will have on perceived usefulness and intention to use.

The model proposed by TAM2 captures a large amount of the variance in user acceptance behavior but constitutes multiple levels of dependent and independent variable relations. Additionally, several constructs, proposed by other social behavioral models, are not included in the models proposed by TAM or TAM2. This led to the development of a more parsimonious model called the unified theory of acceptance and use of technology (UTAUT). This model is shown in figure four.q UTAUT as proposed by Venkatesh, Morris, Davis, and Davis (2003) attempts to synthesize all of the constructs proposed in the extant technology acceptance literature including TAM2.

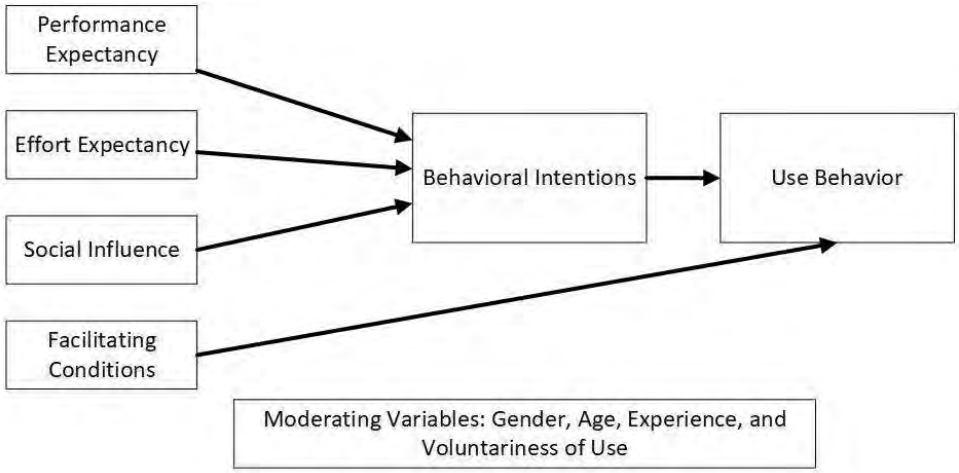


Figure 4 Unified Theory of Acceptance and Use of Technology (UTAUT). Adapted from Venkatesh, Morris, Davis, and Davis (2003).

By examining the entirety of the existing technology acceptance research, the authors of UTAUT were able to develop a model of acceptance that includes the most significant constructs. UTAUT contains a mere four antecedents and four moderating variables. Many of these variables had been identified in TAM or TAM2 but have received some minor updates in definition and operationalizations to properly encompass all of the extant acceptance research. The four primary antecedents proposed in UTAUT are: performance expectancy, effort expectancy, social influence, and facilitating conditions. Performance expectancy is analogous to perceived usefulness and is considered the user's expected or perceived performance increases from using the system. The second construct, effort expectancy, is similarly analogous to a construct first proposed in TAM, perceived ease of use. Effort expectancy is defined as the user's view on the level of effort required to learn or operate the newly introduced technology. Social influence, the third antecedent of UTAUT, has no analogous construct in TAM but is similar to the subjective norm construct included in TAM2. Subjective norm is comparable to peer pressure and social influence, and can be thought of similarly. The final construct, facilitating conditions, has no analogous construct in TAM or TAM2. This construct is synthesized from other social theories and acceptance antecedents. Facilitating conditions is defined as the perceived level of support the user will receive when accepting or using a new technology. The moderating variables of UTAUT are not new to this model. They include age, gender, experience, and

voluntariness of use. These variables are said to affect the relationship between the proposed antecedents and acceptance.

There have been several applications of UTAUT across a wide array of technologies and contexts; including cross-cultural examinations (Im, Hong, & Kang, 2011). However, like TAM, UTAUT has been extended. The extension of UTAUT is known as UTAUT2 (Venkatesh, Thong, & Xu, 2012). This expanded model, shown in figure five, of technology acceptance differs from its source by the addition of three new constructs proposed to affect the acceptance of technology.

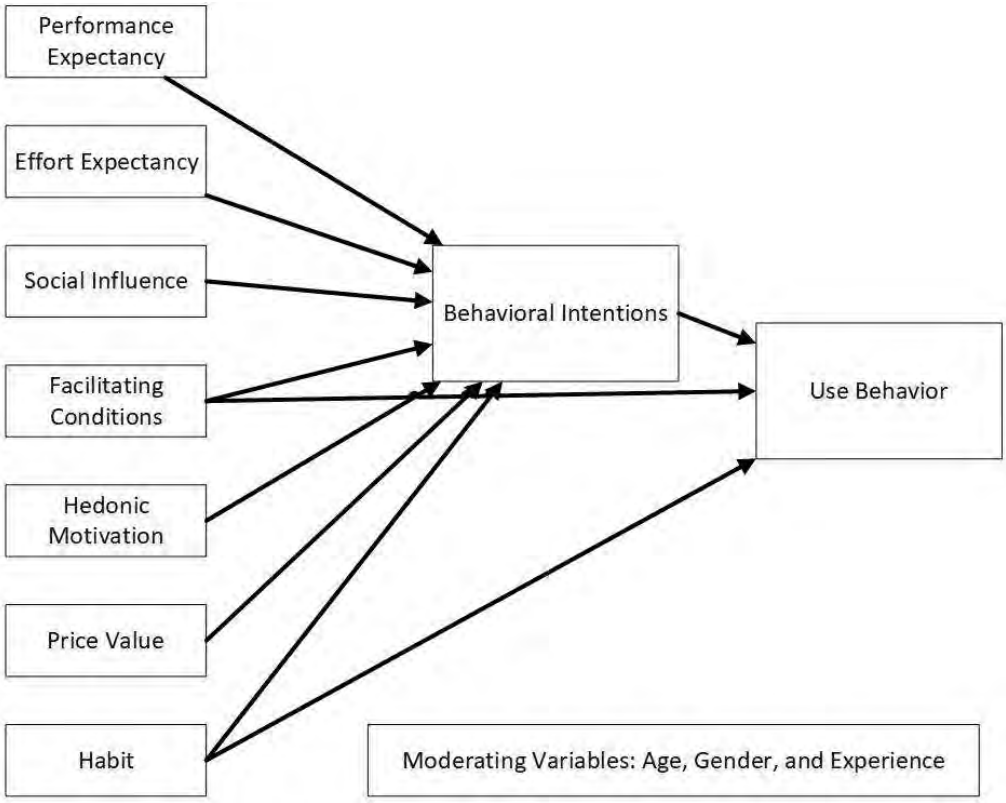


Figure 5 (UTAUT2) Unified Theory of Acceptance and Use of Technology 2 (UTAUT2). Adapted from Venkatesh, Thong and Xu (2012).

The added constructs are: hedonic motivation, price value, and habit. Hedonic motivation is considered the perceived pleasure the user will derive from the new technology. The next construct, price value, was added to capture the perceived value versus the cost of a new technology. This construct is only relevant when the new technology is consumer directed as the

user will need to balance the expended resources versus the expected returns. Habit is the final construct added in UTAUT2. This construct represents the user's familiarity with accepting technology or autonomous acceptance behaviors.

As the models of technology acceptance have developed, they have been applied to a variety of contexts and technologies. The primary research question of this research is concerned with user's acceptance of employer control which lends itself to being examined via the current technology acceptance literature. There have been relatively few applications of social theories in the direct context of BYOD; however, UTAUT has been used to create a variety of models relating to general technology and policy acceptance. Most research has used a combination of variables and constructs from the prevailing social theories in a similar manner as proposed by this research. This suggests that extending and applying TAM and its extensions into acceptance of employer control is appropriate. TAM and UTAUT have been applied to other BYOD related activities. This includes BYOD policy acceptance (Storey, 2017) and employee acceptance of BYOD (Loose et al., 2013). The proposed model for this research is highly influenced by UTAUT2 and the associated acceptance literature.

Research Methodology

The leaders of today's organizations must take steps to protect their sensitive information in light of the ever-expanding adoption of BYOD. Although BYOD brings with it many benefits, it presents a new challenge for IT security. Therefore, managers must be ready to tackle the security concerns presented by this new paradigm. One of the primary methods for protecting confidential information is through the application of MDM. This requires the employee to capitulate to some form of employer interference with their personal device. In order for this method of security to achieve widespread application, employees must be willing to tolerate some employer control. The acceptance of employer control and its associated antecedents is a relatively untapped area of research.

This study seeks to examine and model the factors that may impact an employee's acceptance of employer control over their personal devices. This research question is relevant due to the growth of CIT and the increased implementation of BYOD policies and practices by organizations. This study uses a quantitative and statistics driven methodology by using the preexisting social theories and acceptance literature to construct several hypotheses. These hypotheses posit that an employee's beliefs will impact their likelihood of accepting employer control.

The basis for the model and associated hypotheses presented in this research is the extant social behavior literature and the existing theories into technology acceptance. The previously developed technology acceptance literature is adapted to the context of BYOD behavior by this research. Existing research into employee acceptance has already been completed and a number of behavioral theories have been developed (Davis et al., 1989; Venkatesh et al., 2003, 2012). As previously mentioned, these theories include Technology Acceptance Model (TAM), Unified Theory of Acceptance and Use of Technology (UTAUT), and UTAUT's extension UTAUT2. These theories present a number of constructs that can be adapted and expanded to this previously unexplored area of research. Consequently, this research proposes to use a model that is primarily based on earlier theory (Routio, 2007).

The three aforementioned theories build upon one another and include an increasing number of antecedents theorized to determine technology acceptance. The simplest and most parsimonious model of technology acceptance is TAM which is itself derived from the social theory of planned behavior (Madden et al., 1992). This model includes only attitude and

perceived usefulness as direct antecedents of technology use intention and intention to use as a direct predictor of actual technology use (Davis et al., 1989). UTAUT attempted to synthesize the extant research and create a single model of technology acceptance (Venkatesh et al., 2003). This initial model was later extended into UTAUT2 (Venkatesh et al., 2012). In the UTAUT based models all the constructs are theorized to influence behavior intentions and are moderated by age, gender, and experience. These models and their associated constructs form the foundation on which this research stands. Meaning, the very same constructs proposed in the aforementioned theories can be adapted to employee acceptance of employer control.

The relevant constructs that can be adapted to an employee's acceptance of their employer exercising control over their personally owned devise are: performance expectancy, effort expectancy, social influence, facilitating conditions, habit, and price. These constructs are included in the UTAUT2 model of employee acceptance but have yet to be applied in the same context as this research. Figure 1 shows a path model of the proposed study which establishes the conceptual relationships between the proposed variables.

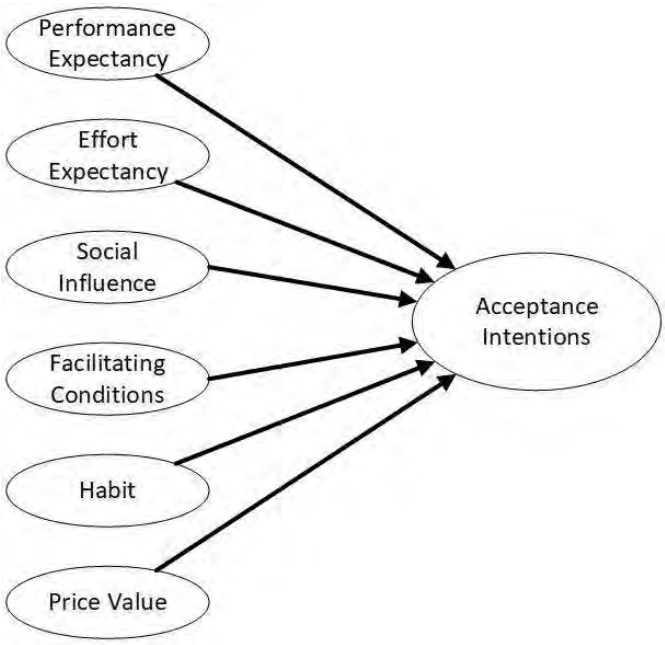


Figure 6 Path Diagram

Hypotheses

The first construct of the employee acceptance model presented in this research, performance expectancy, is the employee's subjective view of how much a technology will enhance their job performance. This construct was originally described in UTAUT as the collection of several related variables including the perceived usefulness construct from TAM (Venkatesh et al., 2003). Performance expectancy has been found to be a strong predictor of behavior intentions (Venkatesh et al., 2003). In the context of this research it is the employee's perceptions that they will benefit from applying or using BYOD. Meaning, the greater the belief by the individual in the positive effects of BYOD on their job performance or abilities, the more likely they will be to accept employer control. The positive effects of the performance expectancy construct on the user's acceptance of control forms the basis of the first hypothesis.

H1: An individual's belief in the performance gains granted by BYOD (performance expectancy) will positively influence their stated acceptance of employer control.

In its original incarnation, effort expectancy, the second construct of the proposed model, was defined as the amount of effort that the employee believes is required to use a new technology resource (Venkatesh et al., 2003). If an employee believes that little effort is required, they will have a greater intention to use new technology. Like performance expectancy, this construct encompasses several related constructs proposed in earlier behavioral theories. This includes the perceived ease of use from the original model of technology acceptance (Venkatesh et al., 2003). Effort expectancy is adapted to this research as an employee's perceived effort required to incorporate BYOD into their everyday work. The easier an employee believes it will be to use BYOD in their job activities the more likely they will be to accept employer control is the second hypothesis.

H2: An individual's beliefs that BYOD will be easy to use (effort expectancy) will positively influence their stated acceptance of employer control.

This research's third construct is social influence which has its origins in behavioral theory. This construct attempts to encapsulate the peer pressure an individual may feel to

conform to a particular action. While not included in the earliest form of TAM it was incorporated as subjective norm into TAM2 and has subsequently been found in UTAUT and UTAUT2 (Davis et al., 1989; Venkatesh & Davis, 2000; Venkatesh et al., 2012). Social influence attempts to measure the individual's beliefs about how other people view the new technology. The employee's subjective view of their coworkers' and supervisors' attitudes towards employer control forms the core of the social influence construct as it applies to this research. The more agreeable the employee believe their coworkers, supervisors, and managers are to employer control the more likely they are themselves to agree to employer control.

H3: An individual's positive perceptions of their peers and supervisor's willingness to accept employer control (social influence) will positively influence their stated acceptance of employer control.

The next construct, facilitating conditions, is concerned with the environment to support the use of a new technology. This construct is fairly general and includes the individual's perceptions of the support they will receive when attempting to integrate a new technology into their workflow and the voluntariness of the new technology. This construct first appeared in the UTAUT model of acceptance (Venkatesh et al., 2003); however, it also includes aspects of voluntariness which was present in TAM2 (Venkatesh & Davis, 2000). This research adapts facilitating conditions as the employee's view of the BYOD technical and managerial support they will receive while complying with the employer's control. This includes the employee's views of the resources, knowledge, and compatibility of BYOD technologies. Meaning that if the employee believes that the organization is serious about BYOD and has invested the appropriate resources to support and train the employee, they are more likely to accept control. The relationship between facilitating conditions and employee acceptance forms the core of the forth hypothesis.

H4: An individual's perception of the employer's support of BYOD (facilitating conditions) will positively influence their stated acceptance of employer control.

The extension of UTAUT added several new constructs to create a new model of employee acceptance which was named UTAUT2 by its authors (Venkatesh et al., 2012). The first construct from UTAUT2 to be included in this research is termed habit. Habit is defined as the employee's prior capitulation to employer control and their tendency to perform behaviors automatically. If the organization has demanded the employee comply with previously introduced controls or security policies then the employee is more likely to submit to future employer controls. Adapting the habit constructs to this research is straightforward as an employee has likely had to understand and follow other policies and procedures regarding technology security. If the employee has followed policies unrelated to BYOD, they are likely to automatically follow policies requesting control of personally owned devices.

H5: An individual's familiarity with employer control (habit) will positively influence their stated acceptance of employer control.

The final construct, which also stems from UTAUT2, is price value. This construct is only relevant when dealing with consumer technology and is the individual's subjective value of the new technology compared to its associated costs (Venkatesh et al., 2012). Traditional IT infrastructure is wholly provided and owned by the employing organization but in BYOD the employee typically bears at least some responsibility for the cost of the device. The employer may provide some monetary reimbursement or benefit to the employee. If the employer pays for a portion of the cost of consumer technology an employee may be more willing to accept some loss of control. Meaning that when an employee believes that the employer should pay for consumer technology, the greater they will perceive the value of using BYOD and consequently the more likely they will be willing to accept employer control.

H6: An individual with higher perceived price versus personal monetary cost (price value) will positively influence their stated acceptance of employer control.

The existing acceptance theories and the associated constructs can be used to develop a new model of employee acceptance of employer control. This new model delivers several

hypotheses which can be empirically tested and verified. The hypotheses are summarized in the table below:

Construct	Hypotheses
Performance Expectancy	H1: An individual's belief in the performance gains granted by BYOD (performance expectancy) will positively influence their stated acceptance of employer control.
Effort Expectancy	H2: An individual's beliefs that BYOD will be easy to use (effort expectancy) will positively influence their stated acceptance of employer control.
Social Influence	H3: An individual's positive perceptions of their peers and supervisor's willingness to accept employer control (social influence) will positively influence their stated acceptance of employer control.
Facilitating Conditions	H4: An individual's perception of the employer's support of BYOD (facilitating conditions) will positively influence their stated acceptance of employer control.
Habit	H5: An individual's familiarity with employer control (habit) will positively influence their stated acceptance of employer control.
Price Value	H6: An individual with higher perceived price versus personal monetary cost (price value) will positively influence their stated acceptance of employer control.

Table 1 Summary of Proposed Hypotheses

Measures

To assess the employee's beliefs, a survey can be administered that uses several measures for each construct. Surveys provide an easy way to collect data and assess an employee's attitudes. This type of data collection is ubiquitous among social research in general and has been applied to address similar research questions in the past (Loose et al., 2013; Storey, 2017). Surveys can adequately measure the constructs and relationships that this research intends to study.

The survey instrument is based on the extant technology acceptance literature that attempts to measure several antecedents of acceptance which are hypothesized to affect a participant's willingness to accept employer control. The instrument is designed to encapsulate each of the latent variables or constructs. To operationalize each of the construct's measures from prior research into employee acceptance, they were examined and adapted to fit the research question proposed by this research. At least three or four measures were developed for each latent construct in order to avoid an underidentified model (Bentler & Chou, 1987). The initial measures developed for this research and the associated reference from which they are derived are shown in the following table. Each measure is individually identified using a two-letter identifier, derived from a shorthand of the associated construct, followed by a single digit identifier (i.e. PE1, PE2, etc.).

Construct	Measures	References
Performance Expectancy (PE)	PE1: I would find a personally owned device useful in my job.	(Loose et al., 2013) (Johnston & Warkentin, 2010)
	PE2: Using a personally owned device would increase my effectiveness on the job.	
	PE3: Using a personally owned device would increase my job motivation.	
	PE4: Using a personally owned device would increase my productivity on the job.	
Effort Expectancy (EE)	EE1: Using a personally owned device for work purposes would take too much time from my normal duties.	(Loose et al., 2013)
	EE2: Learning to use a personally owned device for work purposes would be rather difficult for me.	
	EE3: It would take too long to learn how to use a personally owned device for work purposes to make it worth the effort.	

	EE4: Using a personally owned device for work purposes would hinder my normal duties.	
Social Influence (SI)	SI1: I predict that, people who are important to me think that I should allow my employer to control personally owned devices used for work purposes.	(Loose et al., 2013) (Johnston & Warkentin, 2010)
	SI2: I predict that, people in a company who allow their employer to control their personally owned devices used for work purposes have more prestige than those who do not.	
	SI3: I predict that, my coworkers think that I should allow my employer to control personally owned devices used for work purposes.	
Facilitating Conditions (FC)	FC1: I have the resources necessary to use personally owned technology for work purposes.	(Venkatesh et al., 2012)
	FC2: I have the knowledge necessary to use personally owned technology for work purposes.	
	FC3: The personally owned technology I would use for work purposes is compatible with other technologies I use at work.	
	FC4: I can get help from others when I have difficulties using personally owned technology for work purposes.	
Habit (HA)	HA1: Following my employer's security policies has become habit for me.	(Venkatesh et al., 2012)
	HA2: I always follow my employer's computer security rules.	
	HA3: I follow my employer's computer security rules to the best of my ability.	
	HA4: Following my employer's security policies has become natural for me.	

Price Value (PV)	PV1: My employer should compensate me for all costs for personally owned devices when they are used for work.	(Venkatesh et al., 2012)
	PV2: I would appreciate my employer's financial assistance towards the costs of personally owned devices when they are used for work.	
	PV3: My employer should compensate me for some costs for personally owned devices when they are used for work.	
Acceptance Intentions (AI)	AI1: I would allow my employer to control my personal devices when they are used for work.	(Venkatesh et al., 2012)
	AI2: My employer should be allowed to control my personal devices when they are used for work.	
	AI3: I would accept my employer's control over my personal devices when they are used for work.	

Table 2 Initial Measures for Pretest Instrument

Pretest Data Collection

Since new measures were developed or adapted for use in this study a pretest is recommended (Hair, Black, Babin, & Anderson, 2009). Before beginning data collection Institutional Review Board (IRB) approval was sought and granted. To collect data for the purposes of this pretest a survey was administer using SurveyMonkey, an online survey creation and data collection tool. To find participants for the survey several social media posts were placed on reddit.com/r/samplesize, which calls itself "…a community dedicated to scientific, fun, and creative surveys produced for and by redditors!" ("reddit.com/r/samplesize," 2018). Table three shows the breakdown between the survey source and the rate of completion. In addition, SurveyMonkey provided a targeted collector of 91 participants and the survey was shared by users via other social media platforms. The survey was open for participation between June 15, 2018 and July 9, 2018. A minimum sample size of 100 participants was targeted prior to launching the survey; however, during the time the survey was open a total of 200 individuals

participated. Applying the complete case approach responses with missing data were removed leaving a final total of 163 valid responses.

Source	**Number of Responses**	**Complete Responses**	**Complete Percentage**
reddit.com/r/samplesize	109	106	97.2%
SurveyMonkey Targeted Sample	91	57	62.6%
Total	**200**	**163**	**81.5%**

Table 3 Pretest Response Source and Competition Rate

Pretest Analysis

The first step to validate the measures for the pretest round of data collection is to analyze all of the measures and constructs using confirmatory factor analysis. Confirmatory factor analysis provides an objective and verifiable way to validate that the proposed constructs are accurately measured via the survey instrument. The degrees of freedom can be examined to ensure that the model is identified as underidentified models can cause the statistical results to be unreliable (Bentler & Chou, 1987). With 325 moments of unique elements in the covariance matrix and a total of 71 parameters to be estimated the degrees of freedom for this model is 254. The degrees of freedom for this model is high enough and signifies that the model is identified and that model estimation is possible. This was expected as no construct was measured with less than three measures.

Next the overall fit of the model is examined to determine if the theory matches with the observed results. Table four summarizes selected measures of overall model fit. With the large number of factors, sample size, and indicators the measures of fit must be interpreted. For example, a significant Chi-square value can indicate that the model is statistically different from the observed values. In this case the Chi-square value (449.17) is expected to be significant. A little more give is also needed in the other measure of fit. A comparative fit index (CFI) of 0.9082 is not superb but does suggest an adequate model fit (O'Rourke & Hatcher, 2013). Ideally the CFI would be above 9.5 but the model is complicated, contains a fair number of measures, and has a relatively small sample size. The root mean square error of approximation (RMSEA) is below the .07 threshold at 0.0689. A better fit would see a RMSEA of less than 0.055 but the

current RMSEA suggests a fair fit of the model to the data (O'Rourke & Hatcher, 2013). Especially given that the confidence interval, 0.583 to 0.0792, is not greater than 0.08. The sample size and number of measures allows for a standardized root mean residual (SRMR) value greater than 0.08 with a more restrictive CFI of 0.95. In this case the SRMR value is 0.0784 which tolerates a CFI beyond the desired value (Hair et al., 2009).

Chi-square (X^2)	
Chi-square	449.17
Chi-square p value	<.0001
Degrees of freedom	254
Absolute Fit Measures	
Goodness-of-fit index (GFI)	0.83
Standardized root mean residual (SRMR)	0.078
Parsimony Fit Indices	
Adjusted GFI	0.78
RMSEA	0.069
RMSEA Lower 90% Confidence Limit	0.058
RMSEA Upper 90% Confidence Limit	0.079
Incremental Fit Indices	
Comparative fit index (CFI)	0.91

Table 4 Pretest Measurement Model Overall Fit

Overall the SRMR, RMSEA, and CFI measures indicate a fair fit especially given the number of observations and number of factors. While this is acceptable it may indicate the need for some adjustment of the instrument and necessitate the need for a larger sample size. As the pretest is primarily concerned with testing the measures, further tests of convergent and divergent validity is warranted. This will provide additional validation and insights into the measures. This analysis is presented next.

First internal consistency was examined using Cronbach's alpha (CA). A summary of these results is presented in table five. There are several recommendations of acceptable CA values. Generally a minimum value of 0.7 (Hinkin, 1998) is acceptable with values between 0.8

and 0.9 being desired (O'Rourke & Hatcher, 2013). All of the measures exhibit a value above 0.7 with one notable exception, Facilitating Conditions. This construct has the lowest CA of all the constructs at 0.62 and the largest deviation from the ideal 0.8. It quickly became readily apparent that in the pretest sample data the measure, FC4, was not matching the three other measure for the Facilitating Conditions construct. Recalculating CA without this measure led to a large increase of CA to 0.65. While this is still below the desired 0.7 (Hair et al., 2009) it improves the measurement of this construct. This suggests that the measures for Facilitating Conditions may need to be adjusted before beginning the final round of data collection. The rest of the constructs have acceptable CA statistics.

Construct	Standardized Cronbach's Alpha
Performance Expectancy	0.90
Effort Expectancy	0.81
Social Influence	0.79
Facilitating Conditions	0.62
Recalculated Without FC4	0.65
Habit	0.90
Price Value	0.77
Acceptance Intentions	0.91

Table 5 Pretest Standardized Cronbach's Alpha

Measure	Construct	Estimated Loading	Standard Error	t Value
PE1	Performance Expectancy	0.78	0.04	21.7107
PE2	Performance Expectancy	0.88	0.02	37.1835
PE3	Performance Expectancy	0.76	0.04	20.555
PE4	Performance Expectancy	0.90	0.02	40.1833
EE1	Effort Expectancy	0.66	0.05	12.7637
EE2	Effort Expectancy	0.78	0.04	19.3593
EE3	Effort Expectancy	0.84	0.03	24.6458

EE4	Effort Expectancy	0.62	0.06	11.2711
SI1	Social Influence	0.80	0.04	19.6159
SI2	Social Influence	0.67	0.05	13.014
SI3	Social Influence	0.76	0.04	17.301
FC1	Facilitating Conditions	0.62	0.06	9.7801
FC2	Facilitating Conditions	0.67	0.06	11.0931
FC3	Facilitating Conditions	0.58	0.07	8.7952
FC4	Facilitating Conditions	0.27	0.08	3.2667
HA1	Habit	0.93	0.02	47.8798
HA2	Habit	0.74	0.04	19.0581
HA3	Habit	0.77	0.04	21.7848
HA4	Habit	0.87	0.03	34.4432
PV1	Price Value	0.57	0.06	8.9029
PV2	Price Value	0.70	0.06	11.9823
PV3	Price Value	0.93	0.06	16.6345
AI1	Acceptance Intentions	0.95	0.02	56.3835
AI2	Acceptance Intentions	0.81	0.03	26.1622
AI3	Acceptance Intentions	0.88	0.02	38.3122

Table 6 Pretest Standardized Factor Loading Estimates and t-Values

Convergent validity seeks to demonstrate that each measure correlates with other measures of the same construct or factor. Ideally all of the measures for a single construct will be highly correlated with the other measure for the same construct. To ensure convergent validity the factor loadings can be examined. To simplify the interpretation of the factor matrix a VARIMAX rotation was used. The first step in this process is to verify that the standardized factor loading of each measure is significant. Table six, above, displays the data for this initial test. As desired each measure is significant (Hair et al., 2009). Examining the rotated standardized factor loadings, presented below in table seven, is a bit less fruitful and requires additional interpretation. Several factors emerge clearly and evidently. These include Performance Expectancy (PE), Habit (HA), Effort Expectancy (EE), Price Value (PV), and Acceptance Intentions (AI). Facilitating Conditions and Social Influence are a little more

muddled. A single measure for FC4 does not load on the same factor as the other measures. Meanwhile, Social Influence loads on the same factor as Acceptance Intentions. FC4 seems to load strongly on its own factor which may be overshadowing the effects of the Social Influence measures (highlighted in blue). This strong loading of a single measure, FC4, on a single factor is troubling. With the addition of the effects of FC4 on the construct's Cronbach's alpha this seems like a good measure to remove from this analysis.

	AI	PE	HA	EE	FC	PV	SI
PE1	0.05	0.79	0.05	-0.20	0.21	0.00	0.13
PE2	0.08	0.87	0.04	-0.15	0.15	-0.02	0.04
PE3	0.24	0.81	0.01	-0.08	0.03	0.10	0.04
PE4	0.06	0.90	0.12	-0.10	0.08	0.06	0.10
EE1	0.02	-0.26	0.00	0.65	-0.30	-0.05	-0.11
EE2	0.15	-0.05	-0.06	0.49	-0.65	-0.05	0.16
EE3	0.13	-0.17	-0.06	0.71	-0.41	0.00	0.05
EE4	-0.05	-0.17	-0.07	0.87	-0.03	-0.05	-0.06
SI1	0.78	0.06	0.05	-0.01	-0.04	0.03	0.28
SI2	0.53	0.28	0.03	0.33	-0.11	0.14	0.29
SI3	0.67	0.12	0.04	0.13	-0.11	-0.07	0.32
FC1	-0.02	0.18	0.06	-0.08	0.69	0.01	0.33
FC2	-0.01	0.11	0.02	-0.23	0.80	0.10	-0.10
FC3	0.04	0.25	0.09	-0.13	0.50	0.09	0.45
FC4	0.18	0.13	0.13	-0.04	0.06	-0.04	0.80
HA1	0.06	0.07	0.91	-0.03	0.03	0.02	0.11
HA2	0.17	0.05	0.83	0.01	-0.03	0.09	-0.02
HA3	0.03	0.06	0.86	-0.12	0.09	0.06	-0.04
HA4	0.11	0.02	0.87	0.02	0.07	0.00	0.16
PV1	-0.05	-0.02	0.09	0.06	-0.11	0.80	0.01
PV2	0.07	0.18	0.06	0.03	0.29	0.78	-0.08
PV3	-0.12	0.00	0.00	-0.19	0.07	0.87	0.04
AI1	0.90	0.11	0.15	-0.01	-0.03	-0.03	-0.08
AI2	0.87	0.01	0.02	0.02	0.04	-0.08	-0.01
AI3	0.86	0.09	0.18	-0.07	0.03	-0.04	-0.15

Table 7 Pretest Rotated Standardized Factor Loading (Green > 0.7, Yellow > 0.5, Red > 0.4)

Measure	Construct	Estimated Loading	Standard Error	t Value
PE1	Performance Expectancy	0.75	0.03	25.59
PE2	Performance Expectancy	0.87	0.02	45.66
PE3	Performance Expectancy	0.76	0.03	27.14
PE4	Performance Expectancy	0.88	0.02	47.79
EE1	Effort Expectancy	0.69	0.04	19.04
EE2	Effort Expectancy	0.86	0.03	33.93
EE3	Effort Expectancy	0.73	0.03	22.11
EE4	Effort Expectancy	0.67	0.04	17.68
SI1	Social Influence	0.79	0.03	27.84
SI2	Social Influence	0.59	0.04	13.80
SI3	Social Influence	0.76	0.03	25.00
SI4	Social Influence	0.59	0.04	13.68
FC1	Facilitating Conditions	0.61	0.04	13.69
FC2	Facilitating Conditions	0.68	0.04	17.16
FC3	Facilitating Conditions	0.57	0.05	11.99
FC4	Facilitating Conditions	0.48	0.05	9.15
FC5	Facilitating Conditions	0.61	0.04	13.84
HA1	Habit	0.84	0.02	35.08
HA2	Habit	0.75	0.03	24.14
HA3	Habit	0.72	0.03	21.53
HA4	Habit	0.82	0.03	31.53
PV1	Price Value	0.77	0.04	20.27
PV2	Price Value	0.63	0.04	14.91
PV3	Price Value	0.86	0.04	23.91

Table 8 Pretest Standardized Factor Loadings Estimates and t-Values (without measure FC4)

Removing FC4 from the analysis not only improves Facilitating Conditions' Cronbach's alpha but also improves the analysis of convergent validity. As shown in table eight all of the

standardized factor loadings for each of the remaining measures remain significant. Additionally, the standardized factor loadings are much easier to interpret with each factor cleaning loading to its associated measures. As can be seen in table nine there are five loadings below the desired 0.7 threshold (Hair et al., 2009), EE1, EE2, SI1, FC2, and FC3. With the small sample size none of these values are overly troubling at face value but point to some further adjustment of the instrument.

Next, average variance extracted (AVE) and composite reliability (CR) are examined, shown at the bottom of table nine. Only facilitating conditions (FC) has an AVE value below the desired 0.5 (Hair et al., 2009) although SI is uncomfortably close to the desired 0.5. The ideal CR value is 0.7 (Hair et al., 2009) and is surpassed by each construct; however, FC and SI are relatively close to this minimum value. The evidence is mounting that measures for FC should be strengthened and that SI may also require some adjustment.

	PE	HA	AI	EE	PV	FC	SI
PE1	0.76	0.06	-0.03	-0.26	-0.01	0.23	0.17
PE2	0.88	0.03	0.12	-0.15	0.00	0.16	-0.05
PE3	0.81	0.01	0.21	-0.10	0.11	0.03	0.13
PE4	0.89	0.13	0.02	-0.12	0.05	0.13	0.10
EE1	-0.25	0.00	0.03	0.68	-0.04	-0.25	-0.02
EE2	-0.01	-0.04	0.04	0.65	-0.08	-0.43	0.28
EE3	-0.14	-0.05	0.08	0.82	-0.01	-0.21	0.12
EE4	-0.19	-0.07	-0.07	0.81	-0.03	0.05	0.01
SI1	0.05	0.07	0.57	-0.02	0.01	0.05	0.62
SI2	0.24	0.05	0.23	0.24	0.11	-0.01	0.73
SI3	0.08	0.07	0.35	0.07	-0.11	0.00	0.79
FC1	0.17	0.06	0.00	-0.16	0.01	0.76	-0.03
FC2	0.03	0.00	0.00	-0.47	0.12	0.63	-0.05
FC3	0.25	0.10	0.01	-0.12	0.06	0.68	0.11
HA1	0.07	0.92	0.03	-0.04	0.01	0.05	0.06
HA2	0.06	0.82	0.19	0.04	0.09	-0.01	-0.01
HA3	0.03	0.85	0.01	-0.18	0.06	0.03	0.04
HA4	0.03	0.87	0.10	0.03	-0.01	0.12	0.06
PV1	0.00	0.09	-0.05	0.09	0.80	-0.11	0.00
PV2	0.16	0.05	0.09	-0.04	0.79	0.26	-0.03
PV3	0.00	0.00	-0.13	-0.20	0.86	0.06	0.02
AI1	0.14	0.14	0.89	0.04	-0.02	-0.04	0.23
AI2	0.03	0.02	0.85	0.06	-0.07	0.06	0.24
AI3	0.11	0.16	0.90	-0.04	-0.01	-0.03	0.11
AVE	0.70	0.75	0.78	0.55	0.67	0.48	0.52
CR	0.90	0.92	0.91	0.83	0.86	0.73	0.76

Table 9 Pretest Rotated Standardized Factor Loadings, Average Variance Extracted, and Reliability Estimates (Green > 0.7, Yellow > 0.5, Red = Cross Loading, computed without measure FC4)

	PE	EE	SI	FC	HA	PV	AI
PE	1.00	0.14	0.07	0.22	0.03	0.01	0.05
EE	0.14	1.00	0.06	0.64	0.01	0.05	0.01
SI	0.07	0.06	1.00	0.00	0.03	0.01	0.57
FC	0.22	0.64	0.00	1.00	0.03	0.07	0.00
HA	0.03	0.01	0.03	0.03	1.00	0.00	0.06
PV	0.01	0.05	0.01	0.07	0.00	1.00	0.02
AI	0.05	0.01	0.57	0.00	0.06	0.02	1.00
AVE	0.70	0.55	0.52	0.48	0.75	0.67	0.78

Table 10 Pretest Interconstruct Squared Correlations Estimates (red = values above the AVE, computed without measure FC4)

Opposite convergent validity is divergent validity which seeks to validate that each construct is distinct. The first assessment of divergent validity is an examination of the square correlation estimated between constructs. Ideally the AVE of each construct will be larger than the squared correlations. The squared correlations are shown in table ten with values above the AVE highlighted red. As can be seen there are three values above their respective AVE. Incidentally these values are on the same constructs that were identified as problematic during the test of convergent validity: Facilitating Conditions (FC) and Social Influence (SI). This adds further confirmation that the measures for these constructs may require adjustment. The next assessment of discriminate validity is to examine the rotated factor loadings for any measures that that load above 0.5 on more than one construct. The only measure that fits this assessment is SI1. This measure has fairly close loadings of 0.57 and 0.62, with an erroneous loading on Acceptance Intentions (AI). Social Influence has already been identified as a problem; however, adjusting SI1 should be considered as it has multiple loadings. Overall the discriminate validity is decent with only a few issues that are in alignment with the issues identified during the assessment of convergent validity.

Pretest Results

The instrument required some adjustment before the final round of data collection and analysis. Specifically, in the constructs of facilitating conditions and social influence. Both of these constructs had some issues with the majority of the problems being found in Facilitating Conditions. FC4 seems to be a bit of an outlier and all relevant measures were improved by

removing it from the analysis. This includes Cronbach's alpha and the standardized factor loadings. This suggests that the measures for Facilitating Conditions could use some further refinement in order to better capture this construct. Similarly, Social Influence requires some modifications. This construct was the only construct that was not clearly present in the factor loadings before the removal of FC4. Additionally, after removing FC4, there was still some cross loading between this construct and Acceptance Intentions. This suggests that the Social Influence measure could use some refinement.

To enhance the measurement of these constructs, the survey instrument was altered. Since the sample size was small, a conservative approach was used when deciding how to adjust the instrument. An additional measure was added to both the Facilitating Conditions and Social Influence constructs. This enhances the measurement of the associated constructs without radically altering the instrument. A summary of the modifications is shown in table 11.

Construct	Measures	References
Facilitating Conditions (FC)	FC1: I have the resources necessary to use personally owned technology for work purposes. (Unhanged)	(Venkatesh et al., 2012)
	FC2: I have the knowledge necessary to use personally owned technology for work purposes. (Unchanged)	
	FC3: The personally owned technology I would use for work purposes is compatible with other technologies I use at work. (Unchanged)	
	FC4: I am able to get help when I have difficulties using personally owned technology for work purposes. (Unchanged)	
	FC5: The personally owned technology I would use for work purposes would not interfere with other technologies I use at work. (New)	
Social Influence (SI)	SI1: I predict that, people who are important to me think that I should allow my employer to control personally owned devices used for work purposes. (Unchanged)	(Loose et al., 2013) (Johnston & Warkentin, 2010)
	SI2: I predict that, people in a company who allow their employer to control their personally owned devices used for work purposes have more prestige than those who do not. (Unchanged)	
	SI3: I predict that, my coworkers think that I should allow my employer to control personally owned devices used for work purposes. (Unchanged)	
	SI4: I predict that, my supervisors think that I should allow my employer to control personally owned devices used for work purposes. (Added)	

Table 11 Adjustments to produce the final instrument.

Data Analysis

The overall objective of this research is to create a model of employee acceptance. Successful modeling of employee acceptance can help managers, developers, and researchers develop security paradigms that are effective and efficient. By examining the current behavior and technology acceptance literature, a model was developed. This model proposes several constructs that are hypothesized to influence an employee's intention to accept employer control. In order to empirically test the model, the constructs were operationalized and transformed into several measures derived from the extant literature. A pretest was also conducted to validate the instrument. Including validating the measurement model fit and testing for both convergent and divergent validity. With a valid instrument, a final round of data collection was completed. The details and results of this final analysis are presented next.

Data Collection

Data collection for this round of data analysis proceeded in much the same manner as the pretest data collection. Firstly, IRB approval was received for the modification of the survey instrument. SurveyMonkey was again used to facilitate the collection of data and served as the interface for data collection. The survey was open from August 22, 2018 until October 21, 2018. The survey data was collected using the same methods as the pretest, by advertising the survey on social media via reddit.com/r/samplesize and collecting responses directly from SurveyMonkey. A total of 410 responses were collected; however, after removing responses with missing or incomplete data a total of 298 responses remained, well above the desired 150 minimum sample size. These final 298 responses were used for the final data analysis. The completion rates of each source of participants for the primary round of data collection is shown below in table 12.

The response source and completion percentages for the pretest are also shown in table 12 for comparison with the responses collected in the primary data collection. There was less interest in the survey from social media the second time it was posted on reddit and more responses provided by SurveyMonkey. It is possible that some of the same individuals participated in the pretest and primary rounds of data collection.

Primary Data Collection			
Source	**Number of Responses**	**Complete Responses**	**Complete Percentage**
reddit.com/r/samplesize	51	44	86.2%
SurveyMonkey Targeted Sample	359	254	70.8%
Total	**410**	**298**	**81.5%**
Pretest Data Collection			
Source	**Number of Responses**	**Complete Responses**	**Complete Percentage**
reddit.com/r/samplesize	109	106	97.2%
SurveyMonkey Targeted Sample	91	57	62.6%
Total	**200**	**163**	**81.5%**

Table 12 Primary Data Collection Response Source and Completion Rate (Pretest Data Collection Response and Completion Rate Shown for Comparison)

Demographics

The demographic characteristics of the data are presented in table 13. Collected characteristics include gender, age, education, and IT use. IT use was further divided into IT use in general and IT use for work purposes. The collection of demographic data was grouped into aggregate ranges to help ensure anonymity. As previously stated and shown in table 13, the total sample size was 298. The sample included slightly more females than males with just under 58% female and just over 42% male. The age of the participants was captured in aggregate groups: under 18 (0.3%), 18-24 (8.4%), 25-34 (21.1%), 35-44 (19.1%), 45-54 (14.4%), 55-64 (23.2%) and 65+ (13.4%). Education was similarly grouped with the largest percent of respondents identified as having a college degree (graduated from college 29.9%). The rest of the respondents having some high school (2.4%); completed high school (11.1%); 1 (5.7%), 2 (12%), or 3 (6.0%) years of college; some graduate school (7.7%), or completed graduate school (25.2%). The sample seems familiar with IT as collectively over 80% of the sample has greater than 15 years of IT use. The individual breakdowns of IT use include: 0-5 years (3%), 6-10 (7.2%), 11-15 years (9.1%), 16-20 years (25.5%), and 20+ years (55%). The sample respondents reported

slightly less experience with IT for work purposes as slightly less than half reported greater than 15 years of IT use for work purposes. The individual breakdowns of IT use for work purposes are separated as follows: 0-5 years (19.1%), 6-10 years (17.1%), 11-15 years (14.43%), 16-20 years (17.1%), and 20+ years (31.9%). One individual (0.3%) choose not respond to IT use for work purposes.

Characteristic	n	%
Gender		
Male	126	42.28
Female	172	57.72
Age Range		
Under 18	1	0.34
18-24	25	8.39
25-34	63	21.14
35-44	57	19.13
45-54	43	14.43
55-64	69	23.15
65+	40	13.42
Education (highest completed)		
Some high school	7	2.35
Graduated from high school	33	11.07
1 year of college	17	5.70
2 years of college	36	12.08
3 years of college	18	6.04
Graduated from college	89	29.87
Some graduate school	23	7.72
Completed graduate school	75	25.17
IT Use		
0-5 years	9	3.02
6-10 years	22	7.38
11-15 years	27	9.06
16-20 years	76	25.50
20+ years	164	55.03
IT Use for work		
0-5 years	57	19.13
6-10 years	51	17.11
11-15 years	43	14.43
16-20 years	51	17.11
20+ years	95	31.88

	No Response	1	0.34
Total Sample		298	100.00

Table 13: Demographic Characteristics

Descriptive Statistics

Several descriptive statistics for the sample are shown in table 14 this includes the mean, standard deviation, minimum and maximum. The instrument used a 5-point Likert scale and all indicators had a minimum value of 1 and a maximum value of 5. All of these simple statistics seems fairly reasonable for the associated measures.

Measure	Mean	Std Dev	Minimum	Maximum
PE1	3.56	1.04	1	5
PE2	3.28	1.06	1	5
PE3	3.06	1.07	1	5
PE4	3.3	1.07	1	5
EE1	2.47	1.04	1	5
EE2	2.14	0.99	1	5
EE3	2.22	0.99	1	5
EE4	2.55	1.13	1	5
FC1	3.65	1.02	1	5
FC2	3.97	0.91	1	5
FC3	3.68	0.99	1	5
FC4	3.45	1.04	1	5
FC5	3.74	0.98	1	5
PV1	3.64	1.14	1	5
PV2	4.12	0.96	1	5
PV3	3.87	1.05	1	5
HA1	4.05	0.86	1	5
HA2	4.09	0.86	1	5
HA3	4.20	0.83	1	5
HA4	4.02	0.84	1	5

SI1	2.42	1.09	1	5
SI2	2.49	1.07	1	5
SI3	2.52	1.1	1	5
SI4	3.13	1.16	1	5
AI1	2.38	1.18	1	5
AI2	2.40	1.16	1	5
AI3	2.54	1.25	1	5

Table 14 Descriptive Statistics for all Measures (Mean, SD, Min, Max)

Confirmatory Factor Analysis

Before testing the proposed hypotheses, it is important to apply confirmatory factor analysis to ensure that the latent constructs are appropriately measured by the instrument. Confirmatory factor analysis, or testing of the measurement model, is considered the first step in testing the structural model or the predictive relationship between latent constructs (Hair et al., 2009, p. 639; O'Rourke & Hatcher, 2013, p. 182). This analysis proceeds in a manner similar to the pretest.

Firstly, the degrees of freedom of the model are examined. Like the evaluation in the pretest, the model is identified with 303 degrees of freedom. This comes from a total of 378 unique moments and 75 parameters. The change in degrees of freedom and parameters from the pretest is expected as an additional two measures were included in the model. The four additional parameters come from the two measures and their associated error terms.

Examination of the goodness-of-fit statistics is the next test for the initial measurement model. These statistics are summarized in table 15. Overall the model appears to be a good fit but the index cutoffs must be adjusted to account for the 298 responses and 27 measures (Hair et al., 2009). The overall model Chi-square (X^2) is 585.67 and significant. This is typical considering the number of observation and parameters so other indices need to be examined to provide a better assessment of the model. The CFI reaches 0.93 which is above the suggested values for this sample size (Hair et al., 2009). The SRMR value is just above the ideal 0.05 value but at 0.057 is well below the recommended 0.08 with CFI above 0.92 (Hair et al., 2009). The RMSEA is similar with a value of 0.056. This does not quite reach the ideal 0.05 but is satisfactory (O'Rourke & Hatcher, 2013).

Chi-square (X^2)	
Chi-square	585.67
Chi-square p value	<.0001
Degrees of freedom	303
Absolute Fit Measures	
Goodness-of-fit index (GFI)	0.87
Standardized root mean residual (SRMR)	0.057
Parsimony Fit Indices	
Adjusted GFI	0.84
RMSEA	0.056
RMSEA Lower 90% Confidence Limit	0.049
RMSEA Upper 90% Confidence Limit	0.063
Incremental Fit Indices	
Comparative fit index (CFI)	0.93

Table 15 Model I: Measurement Model Overall Fit

Overall the fit is good and better than the statistics found in the pretest analysis. This suggests that the larger sample size and instrument modifications did not negatively impact the model. The goodness-of-fit statistics are good enough to continue the analysis and assess reliability as well as convergent and divergent validity.

Internal consistency is first examined by assessing Cronbach's alpha (CA). As can be seen in table 16, these values are all within acceptable ranges. Facilitating Conditions and Social Influence have the lowest value at 0.73 and 0.78 respectively. These constructs were identified as problematic during the pretest. However, the Facilitating Conditions construct is vastly improved over the value found in the pretest and Social Influence is relatively similar. Overall the CA values are suitable.

Construct	Standardized Cronbach's Alpha
Performance Expectancy	0.89
Effort Expectancy	0.83
Social Influence	0.78
Facilitating Conditions	0.73
Habit	0.86
Price Value	0.79
Acceptance Intentions	0.92

Table 16 Model I: Standardized Cronbach's Alpha

Measure	Construct	Estimated Loading	Standard Error	t Value
PE1	Performance Expectancy	0.75	0.03	25.59
PE2	Performance Expectancy	0.87	0.02	45.66
PE3	Performance Expectancy	0.76	0.03	27.14
PE4	Performance Expectancy	0.88	0.02	47.79
EE1	Effort Expectancy	0.69	0.04	19.04
EE2	Effort Expectancy	0.86	0.03	33.93
EE3	Effort Expectancy	0.73	0.03	22.11
EE4	Effort Expectancy	0.67	0.04	17.68
SI1	Social Influence	0.79	0.03	27.84
SI2	Social Influence	0.59	0.04	13.80
SI3	Social Influence	0.76	0.03	25.00
SI4	Social Influence	0.59	0.04	13.68
FC1	Facilitating Conditions	0.61	0.04	13.69
FC2	Facilitating Conditions	0.68	0.04	17.16
FC3	Facilitating Conditions	0.57	0.05	11.99
FC4	Facilitating Conditions	0.48	0.05	9.15
FC5	Facilitating Conditions	0.61	0.04	13.84
HA1	Habit	0.84	0.02	35.08

HA2	Habit	0.75	0.03	24.14
HA3	Habit	0.72	0.03	21.53
HA4	Habit	0.82	0.03	31.53
PV1	Price Value	0.77	0.04	20.27
PV2	Price Value	0.63	0.04	14.91
PV3	Price Value	0.86	0.04	23.91
AI1	Acceptance Intentions	0.92	0.01	68.54
AI2	Acceptance Intentions	0.87	0.02	50.74
AI3	Acceptance Intentions	0.88	0.02	54.85

Table 17 Model I: Standardized Factor Loading Estimates and t-Values

The next test is to examine the standardized factor loadings to check the model for convergent validity. As with the pretest analysis a VARIMAX rotation was used to simplify interpretation and hopefully correlate each measure with a single factor. Firstly, the standardized factor loadings for each measure are examined to ensure that each measure has a significant loading. It is evident that each measure is significant, in this case, as can be seen in table 17 above. Next the rotated standardized factor pattern is examined. Upon first analysis, as shown in table 18, these loadings are less than ideal. Similar to the pretest the Social Influence construct is being washed out by the Facilitating Conditions construct. Both FC1 and FC2 correlate extremely well on their own factor. The measures for Social Influence are then strongly correlated with the Acceptance Intention with SI1 showing the strongest correlation.

	AI	PE	HA	EE	PV	FC	SI
PE1	-0.01	0.77	0.14	-0.15	0.02	0.09	0.22
PE2	0.11	0.86	0.06	-0.14	0.05	0.11	0.15
PE3	0.17	0.79	0.04	-0.07	0.04	0.26	-0.05
PE4	0.04	0.87	0.04	-0.10	0.04	0.19	0.09
EE1	0.15	-0.18	-0.09	0.77	0.01	-0.19	0.15
EE2	0.20	-0.10	-0.15	0.79	-0.11	0.02	-0.25
EE3	0.16	0.02	-0.17	0.77	0.00	0.05	-0.15
EE4	0.05	-0.25	-0.05	0.72	0.05	-0.17	-0.09
SI1	0.78	0.08	-0.10	0.15	-0.07	0.04	0.03
SI2	0.57	0.21	-0.03	0.23	0.06	0.19	-0.15
SI3	0.75	-0.04	0.02	0.16	-0.01	0.07	0.26
SI4	0.62	0.00	-0.05	0.09	0.12	-0.06	0.43
FC1	0.02	0.29	0.06	-0.17	0.04	0.27	0.62
FC2	-0.03	0.22	0.22	-0.23	0.11	0.24	0.71
FC3	0.03	0.28	0.04	-0.10	0.13	0.54	0.27
FC4	0.12	0.16	0.18	0.04	0.03	0.70	0.11
FC5	0.09	0.24	0.15	-0.24	0.03	0.69	0.08
HA1	0.06	0.04	0.87	-0.09	0.03	0.06	0.07
HA2	-0.05	0.02	0.83	-0.03	0.00	0.21	-0.05
HA3	0.05	0.12	0.76	-0.18	0.13	0.02	0.10
HA4	0.05	0.08	0.82	-0.11	0.09	0.07	0.08
PV1	-0.04	0.06	0.08	0.05	0.84	0.00	0.05
PV2	-0.04	0.04	0.09	-0.01	0.75	0.18	0.13
PV3	-0.02	0.01	0.05	-0.06	0.89	-0.02	-0.05
AI1	0.89	0.05	0.09	0.00	-0.07	0.04	-0.10
AI2	0.87	0.05	0.08	0.09	-0.09	-0.02	-0.01
AI3	0.86	0.05	0.09	-0.02	-0.01	0.09	-0.12

Table 18 Model I: Rotated Standardized Factor Loading (Green > 0.7, Yellow > 0.5)

Chi-square (X^2)	**Model I: Measurement Model**	**Model II: Modified Measurement Model**
Chi-square	585.67	416.81
Chi-square p value	<.0001	<.0001
Degrees of freedom	303	231
Absolute Fit Measures	**Model I: Measurement Model**	**Model II: Modified Measurement Model**
Goodness-of-fit index (GFI)	0.87	0.90
Standardized root mean residual (SRMR)	0.057	0.053
Parsimony Fit Indices	**Model I: Measurement Model**	**Model II: Modified Measurement Model**
Adjusted GFI	0.84	0.87
RMSEA	0.056	0.052
RMSEA Lower 90% Confidence Limit	0.049	0.044
RMSEA Upper 90% Confidence Limit	0.063	0.060
Incremental Fit Indices	**Model I: Measurement Model**	**Model II: Modified Measurement Model**
Comparative fit index (CFI)	0.93	0.95

Table 19 Comparison of Measures of Fit Between Model I: Measurement Model and Model II: Modified Measurement Model (Model I values copied from table 13 for comparison)

To improve the results, measures SI1, FC1, and FC2 can be dropped from the analysis. This not only improves the convergent validity of the measures but also improves the overall fit of the model. Additionally, the model remains identified with 300 unique moments, 69 parameters, and 231 degrees of freedom. The goodness-of-fit statistics between the two models are summarized in table 19 above. The Chi-square statistic remains significant as expected but more importantly the CFI value has improved to 0.95 which signifies a better fit of the data to the expected model. Additionally, the RMSEA and SRMR are lowered to 0.052 and 0.053 respectively which indicates an ideal fit.

The rotated factor loadings are also vastly improved with the elimination of measures SI1, FC1, and FC2. These values are displayed in the table 20 below. Each set of related measure

loads strongly to a single construct. Only the constructs of Social Influence and Facilitating Conditions have measure loadings less than the ideal 0.7, but all loadings on their associated constructs are above the acceptable 0.5. Similarly, the AVE values for Social Influence and Facilitating Conditions are a bit lower than ideal but the other constructs have excellent CR values. Lastly, the CR statistic surpasses the desired value of 0.7 for each construct. Overall the updated model has standardized factor loadings that support convergent validity.

	PE	HA	AI	EE	PV	SI	FC
PE1	0.78	0.14	-0.01	-0.18	0.03	0.00	0.13
PE2	0.87	0.07	0.06	-0.15	0.05	0.10	0.12
PE3	0.79	0.04	0.17	-0.04	0.03	0.02	0.25
PE4	0.87	0.04	-0.01	-0.11	0.03	0.06	0.21
EE1	-0.17	-0.09	0.05	0.74	0.03	0.19	-0.17
EE2	-0.12	-0.15	0.15	0.83	-0.12	0.03	0.00
EE3	0.01	-0.17	0.12	0.80	0.00	0.03	0.03
EE4	-0.25	-0.05	0.01	0.73	0.05	0.03	-0.18
SI2	0.22	-0.01	0.29	0.26	-0.01	0.54	0.14
SI3	-0.01	0.04	0.45	0.13	-0.04	0.70	0.10
SI4	0.04	-0.03	0.27	0.01	0.10	0.80	-0.01
FC3	0.28	0.04	0.03	-0.13	0.15	0.01	0.63
FC4	0.17	0.19	0.02	0.03	0.01	0.18	0.69
FC5	0.24	0.15	0.13	-0.21	0.03	-0.04	0.69
HA1	0.04	0.86	0.08	-0.10	0.04	0.02	0.07
HA2	0.02	0.84	-0.05	-0.03	-0.02	-0.01	0.19
HA3	0.12	0.77	0.07	-0.19	0.13	0.00	0.03
HA4	0.08	0.82	0.07	-0.12	0.10	-0.01	0.08
PV1	0.06	0.08	-0.04	0.04	0.85	0.01	0.01
PV2	0.05	0.11	-0.17	-0.04	0.73	0.19	0.18
PV3	0.01	0.04	0.06	-0.04	0.90	-0.12	0.00
AI1	0.06	0.07	0.89	0.08	-0.06	0.24	0.05
AI2	0.06	0.06	0.85	0.16	-0.07	0.27	0.00
AI3	0.06	0.06	0.89	0.07	-0.01	0.20	0.10
AVE	0.69	0.65	0.77	0.60	0.69	0.48	0.45
CR	0.90	0.88	0.91	0.86	0.87	0.73	0.71

Table 20 Model II: Rotated Standardized Factor Loadings, Average Variance Extracted, and Reliability Estimates (Green > 0.7, Yellow > 0.5, Red = Cross Loading)

	PE	EE	SI	FC	HA	PV	AI
PE	1.00	0.10	0.03	0.50	0.04	0.01	0.02
EE	0.10	1.00	0.10	0.14	0.10	0.01	0.06
SI	0.03	0.10	1.00	0.06	0.00	0.00	0.57
FC	0.50	0.14	0.06	1.00	0.18	0.03	0.04
HA	0.04	0.10	0.00	0.18	1.00	0.03	0.02
PV	0.01	0.01	0.00	0.03	0.03	1.00	0.01
AI	0.02	0.06	0.57	0.04	0.02	0.01	1.00
AVE	0.69	0.65	0.77	0.60	0.69	0.48	0.45

Table 21 Model II: Interconstruct squared correlations estimates (red = values above the AVE)

To examine divergent validity, the interconstruct squared correlations are shown in Table 21. Only a single value, highlighted in red, is above the AVE. This value belongs to the Social Influence construct and shows a correlation with the Acceptance Intention construct. This likely stems from the SI3 measure which is the only cross loading in the rotated factor loadings. With only a single factor correlating above the AVE and a single cross loading these results are practically ideal. This supports the divergent validity of the measures.

The results of the confirmatory factor analysis are promising and demonstrate the reliability and validity of the survey instrument. Using the criteria presented by O'Rourke and Hatcher this measurement model is nearly ideal (2013, p. 263). The fit indexes are good with a CFI exceeding 0.94 and both RMSEA and SRMR below the desired 0.055. Additionally, each parameter loads significantly against its construct. Lastly, the CR of each construct is above 0.70 with many above 0.80. The only characteristic where this model deviates from the ideal is in the AVE. Only two constructs are near, but fall short, of the absolutely ideal 0.5. Taken as a whole the measurement model is acceptable and moving on to the examination of the structural model and hypothesis testing is reasonable at this juncture.

Structural Equation Modeling

With the measurement model sufficiently validated and strong support for construct validity, the structural model can now be examined. While the measurement model assumes that all of the constructs covary, the structural model enforces paths between the latent constructs. In this case the prevailing behavioral and technology acceptance theories have been used to construct a model that posits Acceptance Intentions to be a be predicted by the other six

constructs: Performance Expectancy, Effort Expectancy, Social Influence, Facilitating Conditions, Habit, and Price Value.

Chi-square (X^2)	**Model II: Modified Measurement Model**	**Model III: Structural Model**
Chi-square	416.81	416.82
Chi-square p value	<.0001	<.0001
Degrees of freedom	231	231
Absolute Fit Measures	**Model II: Modified Measurement Model**	**Model III: Structural Model**
Goodness-of-fit index (GFI)	0.90	0.90
Standardized root mean residual (SRMR)	0.053	0.053
Parsimony Fit Indices	**Model II: Modified Measurement Model**	**Model III: Structural Model**
Adjusted GFI	0.87	0.87
RMSEA	0.052	0.052
RMSEA Lower 90% Confidence Limit	0.044	0.044
RMSEA Upper 90% Confidence Limit	0.060	0.060
Incremental Fit Indices	**Model II: Modified Measurement Model**	**Model III: Structural Model**
Comparative fit index (CFI)	0.95	0.95

Table 22 Comparison of Measures of Fit Between Model II: Modified Measurement Model and Model III: Structural Model (Model II values copied from table 17 for comparison)

The first step in examining the Structural Equation Modeling (SEM) analysis is to compare the goodness-of-fit statistics between the final measurement model and the structural model. These statistics are compared in table 22 above. As can be seen these values are unchanged. This means that specifying the structural relationship did not negatively impact the overall model fit.

Next, the standardized factor loadings are compared between the two models to validate that they do not significantly differ. Table 23 below shows the standardized factor loadings for

each measure when the structural relationships are also specified. The next table below, table 24, shows the comparison of the factor loadings between the modified measurement model and the structural model. A fair number of the measures display no difference or a single significant digit difference. There are only three measures with standardized factor loadings that are more than one hundredth in difference: SI3, FC3 and FC5. SI3 shows the biggest change from 0.76 under the measurement model to 0.82 under the structural model. FC3 and FC5 display a difference of only 0.03 in factor loadings between the two models. Overall these differences are minor and virtually unchanged between models. Although confirmatory factor analysis was previously applied to ensure the validity of the measurement, the stability of the loadings further supports this validity.

Measure	Construct	Estimated Loading	Standard Error	t Value
PE1	Performance Expectancy	0.74	0.03	25.15
PE2	Performance Expectancy	0.87	0.02	44.19
PE3	Performance Expectancy	0.76	0.03	27.53
PE4	Performance Expectancy	0.89	0.02	49.04
EE1	Effort Expectancy	0.70	0.04	19.67
EE2	Effort Expectancy	0.85	0.03	31.88
EE3	Effort Expectancy	0.73	0.03	21.91
EE4	Effort Expectancy	0.67	0.04	17.75
SI2	Social Influence	0.59	0.05	12.96
SI3	Social Influence	0.82	0.03	24.51
SI4	Social Influence	0.63	0.04	14.80
FC3	Facilitating Conditions	0.58	0.05	11.21
FC4	Facilitating Conditions	0.51	0.05	9.49
FC5	Facilitating Conditions	0.64	0.05	13.13
HA1	Habit	0.84	0.02	34.87
HA2	Habit	0.75	0.03	24.42
HA3	Habit	0.72	0.03	21.47

HA4	Habit	0.81	0.03	31.27
PV1	Price Value	0.77	0.04	20.29
PV2	Price Value	0.63	0.04	14.90
PV3	Price Value	0.86	0.04	23.81
AI1	Acceptance Intentions	0.92	0.01	67.56
AI2	Acceptance Intentions	0.87	0.02	48.93
AI3	Acceptance Intentions	0.89	0.02	54.36

Table 23 Model III: Standardized Factor Loading Estimates and t-Values

Measure	**Construct**	**Model II: Modified Measurement Model**	**Model III: Structural Model**
PE1	Performance Expectancy	0.75	0.74
PE2	Performance Expectancy	0.87	0.87
PE3	Performance Expectancy	0.76	0.76
PE4	Performance Expectancy	0.88	0.89
EE1	Effort Expectancy	0.69	0.70
EE2	Effort Expectancy	0.86	0.85
EE3	Effort Expectancy	0.73	0.73
EE4	Effort Expectancy	0.67	0.67
SI2	Social Influence	0.59	0.59
SI3	Social Influence	0.76	0.82
SI4	Social Influence	0.59	0.64
FC3	Facilitating Conditions	0.57	0.58
FC4	Facilitating Conditions	0.48	0.51
FC5	Facilitating Conditions	0.61	0.64
HA1	Habit	0.84	0.84
HA2	Habit	0.75	0.75
HA3	Habit	0.72	0.72
HA4	Habit	0.82	0.81
PV1	Price Value	0.77	0.77

PV2	Price Value	0.63	0.63
PV3	Price Value	0.86	0.86
AI1	Acceptance Intentions	0.92	0.92
AI2	Acceptance Intentions	0.87	0.87
AI3	Acceptance Intentions	0.88	0.89

Table 24 Comparison of Standardized Factor Loadings Between Model II: Modified Measurement Model and Model III: Structural Model

Structural Path Estimates

The structural model is used to estimate the relationships between the latent dependent and independent variables (Gefen, Straub, & Boudreau, 2000). The structural path estimates are summarized in table 25 and overlaid in the path diagram in figure 7. As can be seen, only the relationships between Social Influence and Acceptance Intentions and Habit and Acceptance Intention have t-values above the 1.96 significance level. Meaning these are the only relationships that are supported above a 95% confidence level. The other proposes constructs have relatively small standardized estimates and are not significant in predicting Acceptance Intentions.

Structural Relationship	**Standardized Parameter Estimates**	**Standard Error**	**t value**
Hypothesis 1: PE → AI	0.04	0.09	0.38
Hypothesis 2: EE → AI	0.04	0.07	0.55
Hypothesis 3: SI → AI	0.74	0.06	12.27
Hypothesis 4: FC → AI	-0.03	0.13	-0.23
Hypothesis 5: HA → AI	0.13	0.06	1.96
Hypothesis 6: PV → AI	-0.08	0.05	-1.49

Table 25 Model III: Standardized Parameter Estimates

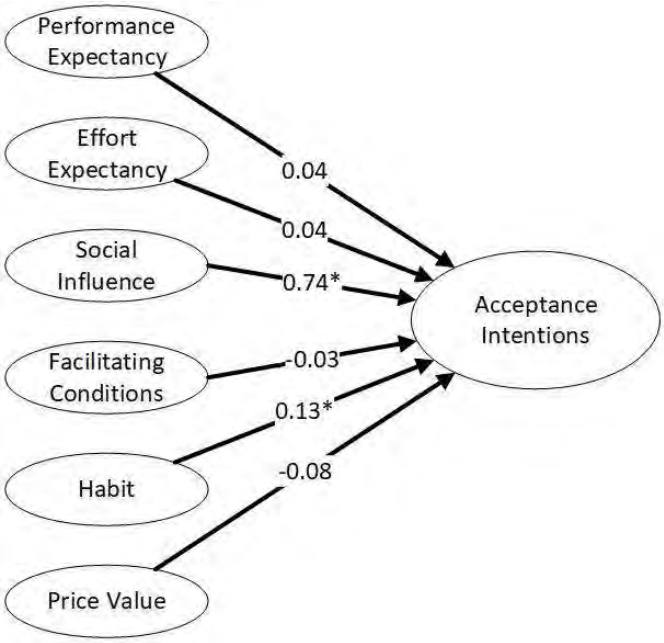


Figure 7 Path Diagram with Estimates (denotes p<0.05)*

The standardized parameter estimates for the two significant factors, Social Influence and Habit, are positive and higher than the estimates for the other factors. Social Influence is well above the other factors and seems to have the most influence on employee acceptance. A conservative approach should be used when interpreting these results, but this research shows that Social Influence is an important factor when it comes to acceptance. To a lesser extent Habit seems to play a part in determining user acceptance intentions. While the relationship between Habit and Acceptance Intentions is significant, the standardized parameter estimate is much lower than that of Social Influence.

Revised Model

The overall fit of the initial model was acceptable and provides some good insight into employee acceptance intentions; however, only two the six proposed hypotheses were significant at a 0.05 probability level. Meaning, only the effects of Social Influence and Habit on Acceptance Intentions surpass the 95% confidence interval of not occurring by random chance alone. The four non-significant paths mean that the model may need to be altered. The revision of the theoretical model is explored next.

Revising the model after data collection has the potential to compromise the generalizability of the results as specific characteristics of the data may have happened by chance (O'Rourke & Hatcher, 2013). The first step in a conservative approach to model revision is simply the elimination of non-significant paths. The Wald test presents chi-square differences for several model modifications and is displayed in table 26 (O'Rourke & Hatcher, 2013). The test confirms that removing the non-significant paths between the exogenous variables and Acceptance Intentions should have a minimal impact on the overall model fit. Although the Wald test also identifies the covariance between Social Influence and Price Value as a potential path for deletion covariance between latent constructs are typically not removed (O'Rourke & Hatcher, 2013).

Parameter	**Cumulative Statistics**		
	Chi-Square	**Difference**	**Pr > ChiSq**
Path FC to AI	0.051	1	0.82
Covariance SI to PV	0.106	2	0.95
Path PE to AI	0.211	3	0.98
Path EE to AI	0.553	4	0.97

Table 26 Output of the Wald Test

With these paths removed the model fit can be reevaluated. The first step is to examine the difference in chi-square for significance. These results are shown in table 27. With a change of four degrees of freedom the difference in chi-square would have to be larger than 9.49 to be significant at a 0.05 probability or 7.78 at a 0.01 probability (O'Rourke & Hatcher, 2013). A difference of 2.67 means that the deletion of all paths outside of Social Influence and Habit from the theoretical model did not significantly change the overall fit. These paths are; therefore, not important to the overall model.

Chi-square (X^2)	**Model III: Structural Model**	**Model IV: Modified Structural Model**	**Difference**
Chi-square	416.82	419.49	2.67
Degrees of freedom	231	235	4

Table 27 Comparison of Chi-square Value between Model III: Structural Model and Model IV: Modified Structural Model.

Discussion

BYOD is here to stay as employees are increasingly using personally owned devices in the work place. These personal devices present a unique security challenge to IT security managers and tricky privacy issues for employees. To address these issues, employers will sometimes use a type of mobile device management to enforce security policies on employee devices. In this case employees must be willing to accept the employer's control over their privately-owned devices. Since BYOD is only getting bigger and security is still an issue, this research sought to examine employee acceptance of employer control over personal devices through modeling employee acceptance.

This research constructed a model of employee acceptance using constructs derived from the existing acceptance theories, particularly UTAUT and its associated extension. In previous research the constructs from UTAUT had been found to be significant in predicting technology acceptance (Venkatesh et al., 2003, 2012). The model proposed by this research consisted of six primary antecedents of an employee's acceptance intentions: performance expectancy, effort expectancy, social influence, facilitating conditions, habit, and price value. All of these constructs are present UTAUT2 but have not been applied in examining acceptance of employer control.

Ideally all six of the hypothesized antecedents would strongly influence an employee's acceptance intentions as prior implementations of UTAUT have had fairly robust predictive power (Venkatesh et al., 2012). However, the empirical test of the model proposed by this research found that only social influence and habit passed significance. Social influence was shown to be highly influential with a large parameter estimate while habit has minimal impact on acceptance intentions.

The outcomes of this research are interesting because they differ so significantly from prior UTAUT and acceptance research. While social influence is significant, the other constructs are typically found to be influential as well. The fact that the other constructs did not provide significant explanatory power is unexpected.

There are several potential explanations for this unusual outcome. The constructs themselves might not have been measured appropriately. Although the confirmatory factor analysis was successful and suggests that each latent construct was appropriately captured there could be issues with the operationalization of each construct. The selected measure may not be

effective in accurately describing the desired construct which would introduce error into the survey by causing participants to diverge on their responses.

Secondly, the constructs themselves might need to be altered. Although UTAUT has been successful in the past it may be missing constructs that are relevant to employee acceptance of control. Prior employee acceptance research has looked at a user's willingness to embrace some new change or technology rather than their acceptance of control. This could mean that when it comes to control of personally owned devices, other models of human behavior may be necessary.

The empirical analysis performed to test the model's ability to explain reality are a bit underwhelming but nevertheless exciting. Social influence is by far and away the most significant contributor to employee acceptance according to the analysis performed in this research. Managers can support or increase social influence before employers attempt to control personally-owned devices. By supporting social influence, managers can ensure that employees are more likely to accept control and thus provide the best environment for fostering BYOD security policy compliance. This could be accomplished by making sure managers stress the importance of acceptance and press the need for security. Additionally, employers could acquire the support of important or influential employees to help spread the necessity of employee acceptance. This will ensure that employees feel the need to accept employer control.

Similarly, employees can request that the control is demonstrated on a smaller number of individuals to ensure it is effective before attempting to apply control over a wider distribution. This will allow the social influence to build while employers and managers move to implement control.

Limitations

This research is limited in its generalizability by its data collection methodology and sample. Only US computer user were targeted for inclusion in this survey and analysis. Further research should be conducted to ensure its generalizability outside of the US and that the results are consistent amongst small subdivisions of users. Additionally, further research should be conducted to further verify the significant constructs of this model and determine if other constructs should be included in employee acceptance behavior.

This research also concentrated on general acceptance of employer control over personally owned devices rather than specific instances of control. The type of control the employer wishes to exert over an employee's device may influence the acceptance of control. This research could be duplicated using other research methodologies or other levels of control to support its further generalizability.

Conclusion

UTAUT has been a popular model for IS research and examining technology acceptance. Additionally, UTAUT has been shown to be fairly robust and able to capture a sufficient amount of variance. Although UTAUT had not been previously applied in the same manner as this research it has been fairly consistent in its explanatory power and ability to identify antecedents of acceptance. The constructs or variables used in this research were derived from existing theory and although not completely ideal do demonstrate the effectiveness of UTAUT.

The analysis showed that the instrument was successful in capturing the constructs but that employees seem slightly reluctant to allow employer to control their personally owned devices. Only the constructs social influence and habit had a significant impact on employee acceptance intentions. According to this research social influence is by far the most predictive construct when it comes to employee acceptance intentions. Habit has a much lower parameter estimate, when compared to social influence and also only just passed significance. The other constructs, performance expectancy, effort expectancy, facilitating conditions, and price value did not pass the significance test and do not have significant parameter estimates. From the empirical analysis of this research, these constructs are not supported as antecedents of acceptance intentions.

The results from this research show that employers and developers wishing to implement a native application on employee's personal devices may need to ensure that social influence and habit are properly supported. Social influence means that key individuals and influencers among the organization should support any implementation of employer control. Employees feel a greater willingness to accept employer control when they believe that other individuals are willing to accept control. To a lesser extent habit should be also be supported to ensure acceptance. This means that organizations where employees are used to strong controls or used to employer control will be more willing to accept further employer security measures. Small

changes prior to implementing employer control may build employee acceptance by establishing a pattern of acceptance.

Appendix A – Institutional Review Board Application and Letters

Human Subject Approval Checksheet

DSU Institutional Review Board
HUMAN SUBJECTS APPROVAL CHECKSHEET

INVESTIGATOR: Complete the checklist below and attach copies of requested items. Obtain the following signatures needed to complete the research approval process. Failure to submit these documents to the Human Subjects Committee will result in a delay in the review/approval process.

CHECKLIST

- [x] Copy of Consent
- [x] Copy of Investigator's Vitae
- [x] Copy of Instrument
- [ ] Approval for Use of Instrument
- [x] Project Approval Application
- [ ] Other

SIGNATURES

Dean's Signature: Please obtain a signature from deans of respective project investigator's college.

Dolline Bennett — Dean/College
4/6/18 — Date

_____ — Dean/College
_____ — Date

Additional Resource Approval: The following request for resources is needed for implementation of this project:

My signature indicates that I support and grant permission for the project to use the above resource.

_____ — Dean/College
_____ — Date

_____ — Dean/College
_____ — Date

COMMITTEE USE ONLY

Date Received: _____ Date Reviewed _____

Risk Level: ○ Exempt ○ Expedited ○ Comprehensive

Disposition: ○ Approved ○ Not Approved ○ Other: _____

Reasons for non-approval: _____

Chair IRB signature: _____

Informed Consent

Dakota State University

Madison, SD

Employee Acceptance of Employer Control Over Personally Owned Devices

Principle Investigator: Kevin R Callies, Doctoral Student

Thank you for your desire to participate in this research study. I am conducting a research project entitled "Employee Acceptance of Employer Control Over Personally Owned Devices" as a part of my graduate program at Dakota State University.

What this study is about:

This research seeks to examine the factors that support employee acceptance of employer control over personally owned devices (e.g. cell phones). This study aims to predict employees' intentions to comply with employer instructions based on their feelings and past behaviors. The sample of this study is adults who regularly use a computer to complete their work. Approximately 500 subjects may be involved in this research.

Your participation in this research is voluntary. There is no penalty or loss of benefits to which you are otherwise entitled for not participating. Additionally, if you decide to participate, you are free to withdraw at any time without any penalty or loss of benefits.

What is the purpose of this research:

There are two primary goals for this research. Firstly, this research seeks to examine the factors that support employee acceptance of employer control over personally owned devices. Secondly, this research seeks to expand the technology acceptance literature.

What we will ask you to do:

This research requires the completion of an online survey which will take about 10 minutes to complete. After agreeing to participate, you will be asked to answer several questions concerning your feelings or thoughts which relate to the use of privately owned devices for work.

What are the potential risks and benefits:

Your participation in this study does not involve any physical or emotional risk to you beyond those encountered in day-to-day life. In the case that you feel uncomfortable with any of the questions or topics we will ask about, you are free to not answer or to skip to the next question. Additionally, you may withdraw or chose to not complete the study at any time. This study is anonymous so no personally identifying information will be collected or stored.

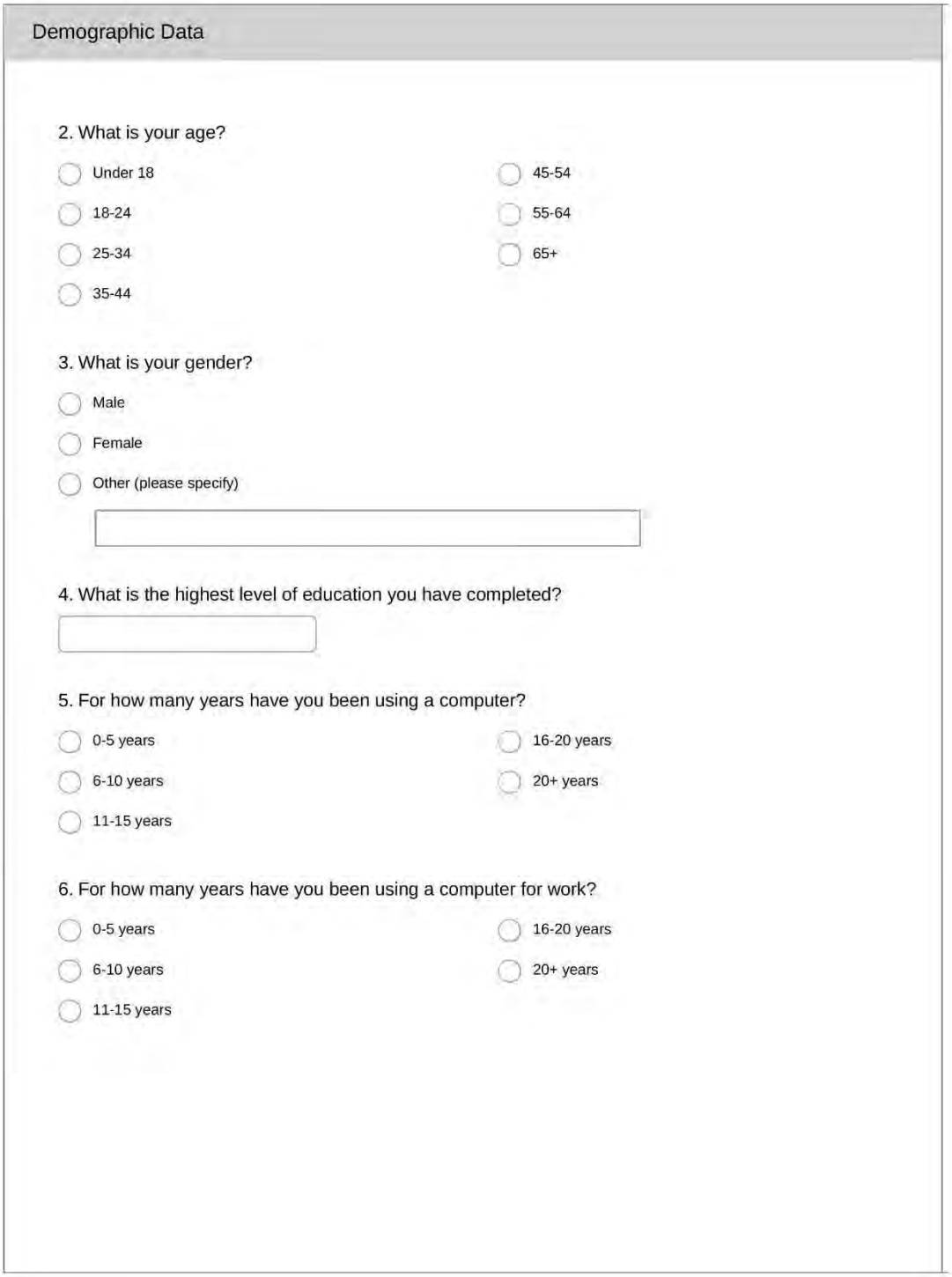
You may not get any direct benefit from participating in this study; however, the research may create a better understanding of user behavior and desires. This in turn may help organizations and businesses develop more effective policies and procedures.

Questions about the research:

Please feel free to contact the principle researcher, Kevin Callies, if you have any additional questions about this study. Kevin Callies can be contacted by email: krcallies@dsu.edu or phone: 605-679-7824.

Additionally, if you have any questions regarding your rights as a research participant in this study, you may contact the DSU Institutional Review Board at 605-256-5100 or at irb@dsu.edu.

Pretest Survey Instrument



Demographic Data

2. What is your age?

- Under 18
- 18-24
- 25-34
- 35-44
- 45-54
- 55-64
- 65+

3. What is your gender?

- Male
- Female
- Other (please specify)

4. What is the highest level of education you have completed?

5. For how many years have you been using a computer?

- 0-5 years
- 6-10 years
- 11-15 years
- 16-20 years
- 20+ years

6. For how many years have you been using a computer for work?

- 0-5 years
- 6-10 years
- 11-15 years
- 16-20 years
- 20+ years

Survey Data

For the next section of questions, please indicate your level of agreement with each statement using the following 5-point response format: 1 = Strongly Disagree, 2 = Disagree, 3 = Neither Disagree nor Agree, 4 = Agree, 5 = Strongly Agree.

For these questions personally owned devices are the device you regularly use for your own purposes (i.e. personal cellphone, smartphone, tablet, or laptop).

If you currently use a personally owned device for work answer each question as it relates to your current use. If you currently do not use a personally owned device for work think about how you could or would use a personally owned device for work.

7. I would find a personally owned device useful in my job.

- ◯ Strongly agree
- ◯ Agree
- ◯ Neither agree nor disagree
- ◯ Disagree
- ◯ Strongly disagree

8. Using a personally owned device would increase my effectiveness on the job.

- ◯ Strongly agree
- ◯ Agree
- ◯ Neither agree nor disagree
- ◯ Disagree
- ◯ Strongly disagree

9. Using a personally owned device would increase my job motivation.

- ◯ Strongly agree
- ◯ Agree
- ◯ Neither agree nor disagree
- ◯ Disagree
- ◯ Strongly disagree

10. Using a personally owned device would increase my productivity on the job.

- ◯ Strongly agree
- ◯ Agree
- ◯ Neither agree nor disagree
- ◯ Disagree
- ◯ Strongly disagree

11. Using a personally owned device for work purposes would take too much time from my normal duties.

- ◯ Strongly agree
- ◯ Agree
- ◯ Neither agree nor disagree
- ◯ Disagree
- ◯ Strongly disagree

12. Learning to use a personally owned device for work purposes would be rather difficult for me.

- ◯ Strongly agree
- ◯ Agree
- ◯ Neither agree nor disagree
- ◯ Disagree
- ◯ Strongly disagree

13. It would take too long to learn how to use a personally owned device for work purposes to make it worth the effort.

- ◯ Strongly agree
- ◯ Agree
- ◯ Neither agree nor disagree
- ◯ Disagree
- ◯ Strongly disagree

14. Using a personally owned device for work purposes would hinder my normal duties.

- ◯ Strongly agree
- ◯ Agree
- ◯ Neither agree nor disagree
- ◯ Disagree
- ◯ Strongly disagree

15. I have the resources necessary to use personally owned technology for work purposes.

- ◯ Strongly agree
- ◯ Agree
- ◯ Neither agree nor disagree
- ◯ Disagree
- ◯ Strongly disagree

16. I have the knowledge necessary to use personally owned technology for work purposes.

- ◯ Strongly agree
- ◯ Agree
- ◯ Neither agree nor disagree
- ◯ Disagree
- ◯ Strongly disagree

17. The personally owned technology I would use for work purposes is compatible with other technologies I use at work.

- ◯ Strongly agree
- ◯ Agree
- ◯ Neither agree nor disagree
- ◯ Disagree
- ◯ Strongly disagree

18. I can get help from others when I have difficulties using personally owned technology for work purposes.

- ◯ Strongly agree
- ◯ Agree
- ◯ Neither agree nor disagree
- ◯ Disagree
- ◯ Strongly disagree

19. My employer should pay for personally owned devices when they are used for work.

- ◯ Strongly agree
- ◯ Agree
- ◯ Neither agree nor disagree
- ◯ Disagree
- ◯ Strongly disagree

20. I would appreciate my employer's financial assistance towards the purchase of personally owned devices when they are used for work.

- ◯ Strongly agree
- ◯ Agree
- ◯ Neither agree nor disagree
- ◯ Disagree
- ◯ Strongly disagree

21. My employer should pay for personally owned devices when they are used for work.

- ◯ Strongly agree
- ◯ Agree
- ◯ Neither agree nor disagree
- ◯ Disagree
- ◯ Strongly disagree

22. Following my employer's security policies has become habit for me.

- ◯ Strongly agree
- ◯ Agree
- ◯ Neither agree nor disagree
- ◯ Disagree
- ◯ Strongly disagree

23. I always follow my employer's computer security rules.

- ○ Strongly agree
- ○ Agree
- ○ Neither agree nor disagree
- ○ Disagree
- ○ Strongly disagree

24. I must follow my employer's computer security rules.

- ○ Strongly agree
- ○ Agree
- ○ Neither agree nor disagree
- ○ Disagree
- ○ Strongly disagree

25. Following my employer's security policies has become natural for me.

- ○ Strongly agree
- ○ Agree
- ○ Neither agree nor disagree
- ○ Disagree
- ○ Strongly disagree

Survey Data

For the next section of questions, please indicate your level of agreement with each statement using the following 5-point response format: 1 = Strongly Disagree, 2 = Disagree, 3 = Neither Disagree nor Agree, 4 = Agree, 5 = Strongly Agree.

For these questions employer control can be thought of as allowing your employer to do something to your personally owned devices. Such as the installation of security software.

26. I predict that, people who are important to me think that I should allow my employer to control personally owned devices used for work purposes.

- ◯ Strongly agree
- ◯ Agree
- ◯ Neither agree nor disagree
- ◯ Disagree
- ◯ Strongly disagree

27. I predict that, people in a company who allow their employer to control their personally owned devices used for work purposes have more prestige than those who do not.

- ◯ Strongly agree
- ◯ Agree
- ◯ Neither agree nor disagree
- ◯ Disagree
- ◯ Strongly disagree

28. I predict that, people who influence my behavior think that I should allow my employer to control personally owned devices used for work purposes.

- ◯ Strongly agree
- ◯ Agree
- ◯ Neither agree nor disagree
- ◯ Disagree
- ◯ Strongly disagree

29. I would allow my employer to control my personal devices when they are used for work.

- ◯ Strongly agree
- ◯ Agree
- ◯ Neither agree nor disagree
- ◯ Disagree
- ◯ Strongly disagree

Human Subjects Approval Request Form

HUMAN SUBJECTS APPROVAL REQUEST
INSTITUTIONAL REVIEW BOARD
DAKOTA STATE UNIVERSITY

The IRB Approval Request is submitted when the research proposal is fully developed, not preliminary. With a fully-developed proposal, answers to most questions in the IRB application will be a simple matter of copying and pasting.

Each investigator involved in the study must have completed CITI online training within the past five years. **The proposed project cannot be carried out until CITI training is complete. If you have any questions, contact irb@dsu.edu.**

DSU policies, procedures, forms, and templates may be found on the DSU Portal.

1. **Principal investigator:** Kevin R Callies

   Email address: krcallies@dsu.edu

   Phone number: 605-940-3523

   DSU College: College of Business & Information Sys Other affiliation (if applicable):

   Graduate Student

   Date of completion of CITI training: 4/14/2018

   If student, faculty advisor: Cherie Noteboom

   Co-investigator(s): Cherie Noteboom

   Co-investigator(s) date(s) of completion of CITI training: 10/2016

2. **Project title:** Employee Acceptance of Employer Control Over Personal Devices

3. **Sponsoring agency:** *(if grant or other funding)*

4. **Project Period:**

   Approximate inclusive dates for study: From 3/2018 to 5/2020

   Contact with participants: From 3/2018 to 8/2018

5. **Location of study:** Online Survey

6. **Number of human subjects who will participate:** 525

7. **Types of participants to be selected:**

☑ Normal Adults ☐ Pregnant Women ☐ Prisoners
☐ Minors ☐ Fetuses ☐ Mentally Disabled/Delayed

8. **Exemption from Committee Review Requested?** Yes

If yes, indicate basis for exemption. Please read the complete descriptions of the six (6) exempt categories of research at 45 CFR 46.101 (b).

☐ Educational Research ☐ Educational Tests ☐ Study of Existing Data
☑ Survey/Interview Research ☐ Observational Research ☐ Food Tasting

(The above do not automatically make a project exempt; it may require expedited or full committee review.)

9. **Will any drugs, chemical or biological agents be administered to human subjects?** No

If yes, include documentation regarding safety from a source other than the manufacturer in ***Methods.***

10. **Will specimens or samples of tissues, body fluids, or other substances be collected from participants?** No

If yes, include details of collection, storage, labeling, use, and disposal in ***Methods.***

11. **Research Protocol:** *Complete a description of the proposed study following the instructions below.*

A. **Introduction:** *Summarize the background, nature, rationale and significance of the proposed study. Attach source information (bibliography) for citations in this narrative.*

The primary focus of this research is employee acceptance of employer control over personal devices. Employees are increasingly demanding to be allowed to use their own personal devices, or other consumer technology, for work related tasks even if it goes against an organization's current security policy (Dillow, 2013; Eddy, 2013). When companies allow employees to use personal devices for work related task it is typically referred to as Bring Your Own Device or BYOD for short. The use of personal devices for work activities opens up a whole new arena of security and privacy concerns (Miller, Voas, & Hurlburt, 2012). Several solutions have been proposed for the organizational concern of privacy including exerting some control over the employee's privately-owned device (French, Guo, & Shim, 2014). These solutions include employees installing special applications or device management software to maintain control over the organization's sensitive data. A key aspect of this security paradigm is the employee's consent. This research proposes to adapt the Unified Theory of Acceptance and Use of Technology (UTAUT) and its extension as a model for employee acceptance of employer control over their personally owned devices.

B. **Objectives:** *State the specific objectives of the research (research questions).*

There are two primary goals for this research. Firstly, this research seeks to examine the factors that support employee acceptance of employer control over personally owned devices. This can be useful for managers, developers, and employees. Managers and employees can design effective policies and procedures for securing BYOD. Additionally, security software developers can focus on security paradigms that best support employees' and employers' desires.

Secondly, this research seeks to expand the technology acceptance literature into a new domain and provide empirical evidence. This research applies prior research into acceptance into a hitherto untapped area of acceptance and also seeks to quantitatively test it. This will expand the growing literature into technology acceptance.

C. **Participants:** *Describe the setting in which the study will be conducted. Quantitative researchers should discuss and describe the population, sample frame, sample and number of participants. If the exact number is not known prior to recruitment, a minimum/ maximum range is acceptable. Qualitative researchers should describe the general population characteristics and the number of participants.*

The study will be conducted as an online survey. The study will be advertised via social media, reddit.com/r/samplesize, and will screen for a population that includes any employees that currently use a computer for work activities. The desired sample includes adults in the United States, any gender, working for any type of organization.

The minimum sample size is 100 participants for a pilot round of sampling and an additional 150 participants after the measures have been tested. The maximum sample size of the pre-test would be 250 and the maximum sample size of the primary study would be 500.

D. **Time Required for Individual Participants:** *State the amount of time required from a single participant. If more than one session/contact is required, list all activities and time required.*

The survey should take less than 10 minutes.

I have tested the survey length myself and had several family members, unfamiliar with the project, test the survey length. The current average test length is 8 minutes 29 seconds with no test longer than 10 minutes.

E. **Compensation to Participants:** *Include any financial, extra credit, and/or any other forms of compensation. Be explicit about what portion(s) of the study the participant must complete to obtain the compensation. If this is a class where extra credit is being offered as compensation, it must be stated that alternative opportunities to obtain extra credit are available for equivalent amounts of work.*

No compensation will be directly provided to participants.

F. **Benefits to Participants:** *If the participants would directly benefit from the results of the study, this should be listed. If the participants will probably not benefit in any way, state "none." In studies involving risk, discuss the relationship between risks and benefits.*

There are no direct benefits to participants; however, the research may create a better understanding of user behavior and desires. This in turn may help organizations and businesses develop more effective policies and procedures.

G. **Methods:** *Details for all procedures must be included. Describe the activities in which subjects will engage. If devices are involved in the interaction with participants, describe how they are used. Instruments which are to be used to collect information (questionnaires, observation recording form, case report forms, etc.) must be provided.*

I have created a survey instrument based on the extant technology acceptance literature that attempts to measure several antecedents of acceptance which are hypothesized to affect a participants willingness to accept employer control. The instrument is designed to quantify each of the proposed variables.

I will invite participants to take the survey via social media, primarily reddit.com/r/samplesize. The desired sample is any US adults that uses a computer for work activities. There are no restrictions on gender or type of organization.

My study is designed to have two rounds of surveying. The first round will be used to test the loadings of the variables to validate the instrument. If necessary the instrument will be slightly refined before the second round of testing. Final analysis will use SEM to test the hypotheses.

The ultimate purpose of this research is to fulfill the dissertation component of my D.Sc. IS program. As such I hope to eventually write the results and present them to my dissertation committee. Additionally I hope to present this research to the wider community as a conference or journal article.

H. **Risks to Participants:** *Please evaluate and discuss **all** potential risks of the study. Any physical, emotional, economic or other risks must be listed. Risks must be classified as no greater than minimal or greater than minimal risk. **Projects involving risk of physical injury, civil, financial or criminal liability, risk to a subject's employment, or where the research involves sensitive aspects of subjects' own behavior such as illegal conduct, drug use, sexual behavior, or use of alcohol (if underage), has the potential of involving more than minimal risk.** If you believe there are no known risks in participation, please indicate that there are no known or no foreseeable risks.*

Their is a small risk to the confidentiality of the participant as some demographic personal information is requested (age, gender, and computer experience). In an attempt to address this the demographic data is aggregated into ranges whenever possible so re-identification is minimized.

Additionally, participants are asked about their prior compliance to employee security policies which may be sensitive; however, participation is anonymous and instructed to skip any question that they find objectionable. Survey Monkey has specifically been configured to anonymous mode so IP addresses are not stored.

I. **Risk Reduction:** *List the steps taken to reduce or prevent risks listed in G.*

The data will be collected via Survey Monkey. Access to the data is protected via a strong password known only by myself, see section J for more data storage detail.

Additionally, I will make every effort to preserve the participant's confidentiality by collecting the minimal amount of demographic data and aggregating the demographic data into ranges when available. The participant's IP addresses is not collected.

J. **Confidentiality & Data:** *List the steps taken to keep the identity of the participants confidential. Explain how data will be reported (e.g., aggregated, anonymity of participants, pseudonyms for participants). Describe where data will be stored and who will have access to them. Describe how data will be used (e.g., in presentations, thesis, publications) and a date for the destruction of personal information. Where applicable, describe what will happen to video/audio recordings at the end of the study. Any project conducted via the Internet must detail measures to assure appropriate computer security issues.*

Survey data will be collected through Survey Monkey and stored. Survey Monkey will store everything online. Data will be downloaded and exported a spreadsheet, which can subsequently be imported into data anlaysis software (Atlas TI).

Only I will have access to the survey results. Exported data will be stored in a secure Dropbox and analyzed on a password protect personally owned computer.

I hope to present my findings to the larger research community via conference and journal articles. The location or employer of the participant is not collected and will not be included in any analysis or results. I will make no attempts to identify any participants in any of my presentations or publications.

K. **Recruitment:** *Contact information for all participants should be obtained using acceptable research methods. State all details of how participants will be recruited for the study. Include how the names/contact information for all participants will be obtained. Include a copy of any advertisements, flyers, or posters to be used in an Appendix.*

Recruitment will be conducted via email links or posted to Reddit. Members of the targeted population will be asked to click a link which will take them to the survey.

13. **Informed Consent:** *Attach copies of all forms which will be used to obtain a legally effective informed consent of human subjects or their legal representatives, or justification why informed consent should be altered or waived. The elements of informed consent and templates can be found in the "Research" area of the DSU Portal.*

14. **Attach all required documents. Attached are:**

- ☐ Research protocol (if completed as a separate document)
- ☑ Consent and assent documents/information (Informed Consent)
- ☑ Recruitment materials
- ☑ Other (please specify)

Survey Instrument
Language for Recruitment Post Submitted on Separate Sheet

Authorized Signatures

Principal Investigator signature: Kevin R Callies Date 4/17/2018

Advisor (if student project): For dissertations and other student research, the IRB application is submitted after the research proposal has been written, *in consultation with and approved by the faculty advisor.* **The advisor is a co-investigator, and the advisor's signature means that the research proposal is complete, the student is ready to gather data, and the advisor has approved the proposal.**

Advisor signature: Cherie Notaboom Date 4/17/2018

Department Head or Dean Donna Bennett Date 4/18/18

DSU DAKOTA STATE Human Subjects Approval Request 7

Sample Recruitment Post

Kevin R Callies

Title: Employee Acceptance of Employer Control Over Personal Devices

Recruitment post statements that would be added in Reddit/r/samplesize:

[Academic] Employee Acceptance of Employer Control (US Working Adults)

[Repost] [Academic] Employee Acceptance of Employer Control (US Working Adults)

Pretest Data Collection Approval Letter

Dakota State University • 820 North Washington Ave. • Madison, SD 57042-1799

DSU Institutional Review Board **Exempt Project Approval**

To: Kevin Callies
Date: 5-23-18
Project Title: **Employee Acceptance of Employer Control Over Personal Devices**

Approval #: 2017-18-12

The Dakota State University IRB has reviewed the above noted project and determined the activities exempt from IRB review on May 23, 2018 in accordance with the regulations that govern the protection of human subjects in research as described in 45 CFR 46.101 (b). The activities included in your submitted protocol materials are applicable to the "exempt" category conditions stated below:

Research activities in which the only involvement of human subjects will be in one or more of the following categories are exempt from this policy:

(2) Research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures or observation of public behavior, unless: (i) information obtained is recorded in such a manner that human subjects can be identified, directly or through identifiers linked to the subjects; and (ii) any disclosure of the human subjects' responses outside the research could reasonably place the subjects at risk of criminal or civil liability or be damaging to the subjects' financial standing, employability, or reputation.

While your project is exempt from review, your research must be conducted according to the final plan reviewed and determined exempt by the DSU IRB. You must notify the IRB of:

- Any changes to your research plan including any information provided in the application and/or other documents submitted;
- Any unexpected or adverse event that occurs in relation to your research project; and
- A notice of closure once all study procedures have concluded.

If you have any questions regarding this determination or during the course of your study, please contact us at 605-256-5038 or irb@dsu.edu. We are happy to provide guidance as needed.

Yours truly,

Jack H. Walters, Chair
DSU Institutional Review Board

DSU Project Update/Amendment Form

Date Received:
Protocol Number:

DSU Project Update/Amendment Form

Submit one copy of this form and all other applicable materials to: irb@dsu.edu

Today's Date: 08/22/18

Project Title: Employee Acceptance of Employer Control Over Personally Owned Devices

Principal Investigator: Kevin R Callies Email: krcallies@dsu.ed Phone: 6059403523

Department / School: College of Business and Information System

Co-Investigator: Cherie Noteboom Email: Cherie.Noteboom Phone: 6052565257

Department / School: College of Business and Information System

Department Dean: Dorine Bennett Email: dorine.bennett@ Phone: 6052565176

For Dissertation Research - **cc your Dissertation Chair your emailed IRB submission**

What are you revising?

For a change to your study plan (significant change to project), please complete the IRB Application form.

- ☐ Consent form
- ☐ Advertisements
- ☐ Recruitment Materials
- ☐ Inclusion / Exclusion Criteria
- ☒ Questionnaire/survey
- ☐ Adding locations/sites
- ☐ Data Management Plan
- ☐ Other:

1. **Change of Personnel:**
   - ☐ Add investigators/personnel (attach list of names, email addresses and dates of CITI completion)
   - ☐ Remove Personnel (list names)
2. **Is the change significant?**
   - ☐ Yes (*Update and attach original IRB application*)
   - ☐ No
3. **Please describe the change.**
   Adding four additional questions to the survey. This increases the survey from 31 total questions to 35.
4. **What is the reason for the change? Explain rationale:**
   Pretest analysis identified several constructs that could use improvements in measurement.
5. **How would the proposed revision change the level of risk to the subjects?**
   - ☐ Increase
   - ☐ Decrease
   - ☒ No change
6. **If the proposed change increases the risk, briefly describe the risk level. Consider level of protection, data safety, potential benefits, and changes to study populations.**
7. **What impact will this have on the study and/or the participants?**
   The survey will take slightly longer to complete. Four additional questions are unlikely to take significantly more time.

Page 1 of 2

8/2018

8. **Are there changes needed to the consent form?** ☐ Yes ☑ No
If yes, attach a copy of the revised consent with the changes tracked or underlined and a clean copy for the IRB date-stamp.

9. **If consent is revised do you have subjects enrolled with the previous consent?** ☐ Yes ☑ No

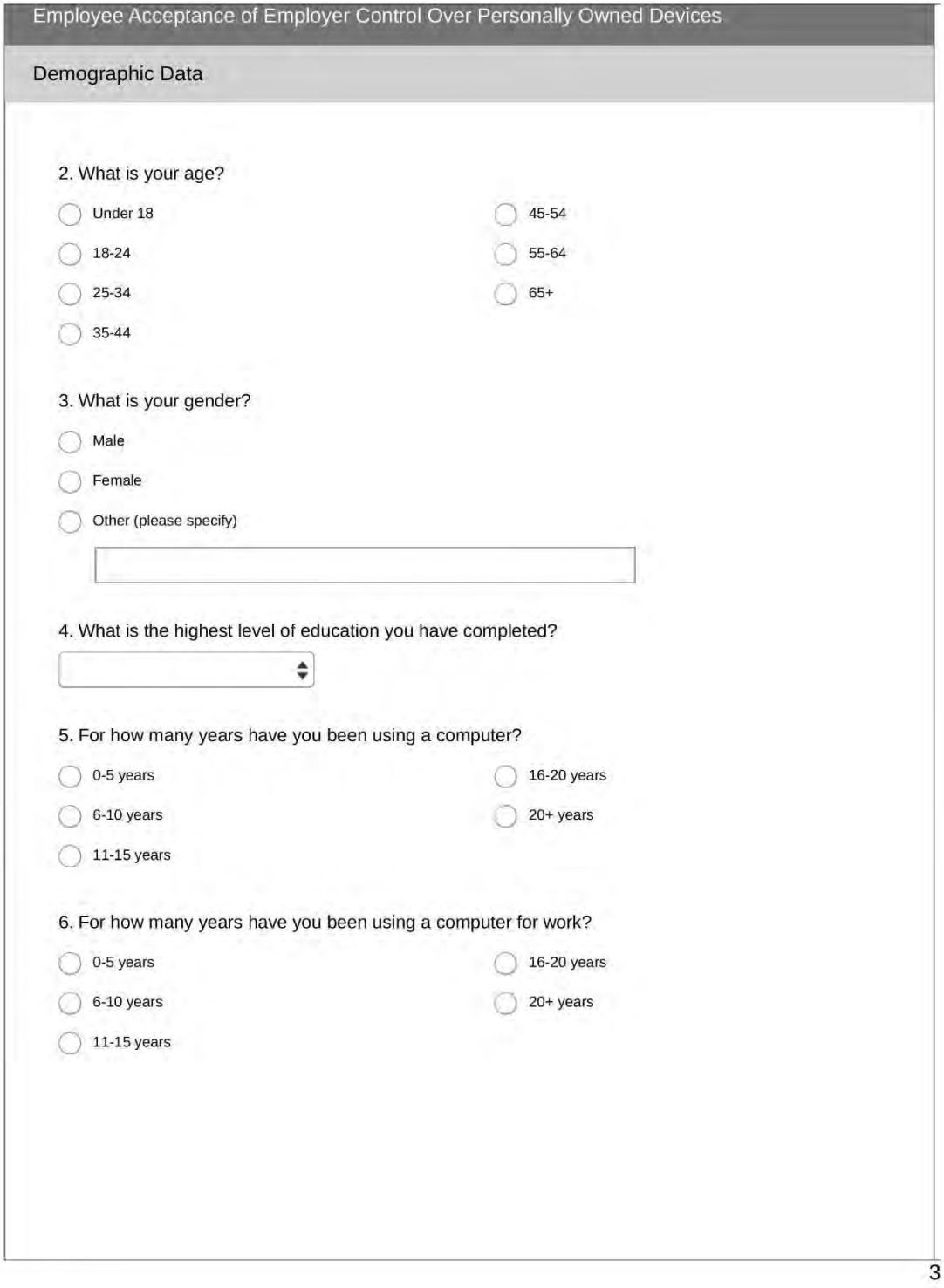
10. **Does the revised consent require re-consenting of enrolled subjects? If yes, attach a plan to reconsent.** ☐ Yes ☑ No

11. **Attach all modified documents:**
- ☐ Informed consent
- ☐ Protocol
- ☐ Date Security Management Plan
- ☐ Verbal Communication Scripts
- ☐ Recruitment Materials
- ■ Surveys, questionnaires, interview questions
- ☐ Other modified documents or added investigators/personnel

Kevin R Callies

Principal Investigator: Signature	Kevin R Callies	08/22/18
		Date
Co-Investigator: Signature		
		Date

Final Data Collection Instrument



Employee Acceptance of Employer Control Over Personally Owned Devices

Demographic Data

2. What is your age?

- Under 18
- 18-24
- 25-34
- 35-44
- 45-54
- 55-64
- 65+

3. What is your gender?

- Male
- Female
- Other (please specify)

4. What is the highest level of education you have completed?

5. For how many years have you been using a computer?

- 0-5 years
- 6-10 years
- 11-15 years
- 16-20 years
- 20+ years

6. For how many years have you been using a computer for work?

- 0-5 years
- 6-10 years
- 11-15 years
- 16-20 years
- 20+ years

3

Employee Acceptance of Employer Control Over Personally Owned Devices

Survey Data

For the next section of questions, please indicate your level of agreement with each statement.

For these questions personally owned devices are the device you regularly use for your own purposes (i.e. personal cellphone, smartphone, tablet, or laptop).

If you currently use a personally owned device for work answer each question as it relates to your current use. If you currently do not use a personally owned device for work think about how you could or would use a personally owned device for work.

7. I would find a personally owned device useful in my job.

- ◯ Strongly agree
- ◯ Agree
- ◯ Neither agree nor disagree
- ◯ Disagree
- ◯ Strongly disagree

8. Using a personally owned device would increase my effectiveness on the job.

- ◯ Strongly agree
- ◯ Agree
- ◯ Neither agree nor disagree
- ◯ Disagree
- ◯ Strongly disagree

9. Using a personally owned device would increase my job motivation.

- ◯ Strongly agree
- ◯ Agree
- ◯ Neither agree nor disagree
- ◯ Disagree
- ◯ Strongly disagree

10. Using a personally owned device would increase my productivity on the job.

- ◯ Strongly agree
- ◯ Agree
- ◯ Neither agree nor disagree
- ◯ Disagree
- ◯ Strongly disagree

11. Using a personally owned device for work purposes would take too much time from my normal duties.

- Strongly agree
- Agree
- Neither agree nor disagree
- Disagree
- Strongly disagree

12. Learning to use a personally owned device for work purposes would be rather difficult for me.

- Strongly agree
- Agree
- Neither agree nor disagree
- Disagree
- Strongly disagree

13. It would take too long to learn how to use a personally owned device for work purposes to make it worth the effort.

- Strongly agree
- Agree
- Neither agree nor disagree
- Disagree
- Strongly disagree

14. Using a personally owned device for work purposes would hinder my normal duties.

- Strongly agree
- Agree
- Neither agree nor disagree
- Disagree
- Strongly disagree

15. It would be easy for me to learn to use personally owned devices for work purposes.

- Strongly agree
- Agree
- Neither agree nor disagree
- Disagree
- Strongly disagree

16. Learning to use personally owned devices for work purposes is easy for me.

- Strongly agree
- Agree
- Neither agree nor disagree
- Disagree
- Strongly disagree

5

17. I have the resources necessary to use personally owned technology for work purposes.

- Strongly agree
- Agree
- Neither agree nor disagree
- Disagree
- Strongly disagree

18. I have the knowledge necessary to use personally owned technology for work purposes.

- Strongly agree
- Agree
- Neither agree nor disagree
- Disagree
- Strongly disagree

19. The personally owned technology I would use for work purposes is compatible with other technologies I use at work.

- Strongly agree
- Agree
- Neither agree nor disagree
- Disagree
- Strongly disagree

20. I am able to get help when I have difficulties using personally owned technology for work purposes.

- Strongly agree
- Agree
- Neither agree nor disagree
- Disagree
- Strongly disagree

21. The personally owned technology I would use for work purposes would not interfere with other technologies I use at work.

- Strongly agree
- Agree
- Neither agree nor disagree
- Disagree
- Strongly disagree

22. My employer should compensate me for all costs for personally owned devices when they are used for work.

- Strongly agree
- Agree
- Neither agree nor disagree
- Disagree
- Strongly disagree

6

23. I would appreciate my employer's financial assistance towards the costs of personally owned devices when they are used for work.

- Strongly agree
- Agree
- Neither agree nor disagree
- Disagree
- Strongly disagree

24. My employer should compensate me for some costs for personally owned devices when they are used for work.

- Strongly agree
- Agree
- Neither agree nor disagree
- Disagree
- Strongly disagree

25. Following my employer's security policies has become habit for me.

- Strongly agree
- Agree
- Neither agree nor disagree
- Disagree
- Strongly disagree

26. I always follow my employer's computer security rules.

- Strongly agree
- Agree
- Neither agree nor disagree
- Disagree
- Strongly disagree

27. I follow my employer's computer security rules to the best of my ability.

- Strongly agree
- Agree
- Neither agree nor disagree
- Disagree
- Strongly disagree

28. Following my employer's security policies has become natural for me.

- Strongly agree
- Agree
- Neither agree nor disagree
- Disagree
- Strongly disagree

Employee Acceptance of Employer Control Over Personally Owned Devices

Survey Data

For the next section of questions, please indicate your level of agreement with each statement.

For these questions employer control can be thought of as allowing your employer to do something to your personally owned devices. Such as the installation of security software.

29. I predict that, people who are important to me think that I should allow my employer to control personally owned devices used for work purposes.

- ◯ Strongly agree
- ◯ Agree
- ◯ Neither agree nor disagree
- ◯ Disagree
- ◯ Strongly disagree

30. I predict that, people in a company who allow their employer to control their personally owned devices used for work purposes have more prestige than those who do not.

- ◯ Strongly agree
- ◯ Agree
- ◯ Neither agree nor disagree
- ◯ Disagree
- ◯ Strongly disagree

31. I predict that, my coworkers think that I should allow my employer to control personally owned devices used for work purposes.

- ◯ Strongly agree
- ◯ Agree
- ◯ Neither agree nor disagree
- ◯ Disagree
- ◯ Strongly disagree

32. I predict that, my supervisors think that I should allow my employer to control personally owned devices used for work purposes.

- ◯ Strongly agree
- ◯ Agree
- ◯ Neither agree nor disagree
- ◯ Disagree
- ◯ Strongly disagree

33. I would allow my employer to control my personal devices when they are used for work.

- Strongly agree
- Agree
- Neither agree nor disagree
- Disagree
- Strongly disagree

34. My employer should be allowed to control my personal devices when they are used for work.

- Strongly agree
- Agree
- Neither agree nor disagree
- Disagree
- Strongly disagree

35. I would accept my employer's control over my personal devices when they are used for work.

- Strongly agree
- Agree
- Neither agree nor disagree
- Disagree
- Strongly disagree

Final Data Collection (Amendment) Approval Letter

Dakota State University Institutional Review Board • 820 North Washington Ave. • Madison, SD 57042

DSU Institutional Review Board **Exempt Project Amendment to Project Review**

To: Kevin Callies
Date: 9-17-18
Project Title: **Employee Acceptance of Employer Control Over Personal Devices**

Approval #: 2017-18-12

The Dakota State University IRB has reviewed your notification of minor changes to the above noted project (reviewed and determined exempt from IRB review on May 21, 2018) and determined that your project remains exempt in accordance with the regulations that govern the protection of human subjects in research as described in 45 CFR 46.101 (b). The research activities (with changes you have submitted with updated project materials) are applicable to the "exempt" category conditions stated below:

Research activities in which the only involvement of human subjects will be in one or more of the following categories are exempt from this policy:
(2) Research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures or observation of public behavior, unless: (i) information obtained is recorded in such a manner that human subjects can be identified, directly or through identifiers linked to the subjects; and (ii) any disclosure of the human subjects' responses outside the research could reasonably place the subjects at risk of criminal or civil liability or be damaging to the subjects' financial standing, employability, or reputation.

While your project remains exempt from review, your research must be conducted according to the final (most recent) plan reviewed and determined to remain exempt by the DSU IRB. You must notify the IRB of:

- Any changes to your research plan including any information provided in the application and/or other documents submitted;
- Any unexpected or adverse event that occurs in relation to your research project; and
- A notice of closure once all project activities have concluded.

If you have any questions regarding this determination or during the course of your study, please contact us at 605-256-5038 or irb@dsu.edu. We are happy to provide guidance as needed.

Yours truly,

Recoverable Signature

X

Dan Friedrich
Chair
Signed by: IRBclosure

Dan Friedrich, Chair
DSU Institutional Review Board

Appendix B – SAS Code

Model I: Measurement Model Analysis

```
proc calis data=final covariance modification;
    LINEQS
        pe1 = l_pe1 f_pe + e1,
        pe2 = l_pe2 f_pe + e2,
        pe3 = l_pe3 f_pe + e3,
        pe4 = l_pe4 f_pe + e4,

        ee1 = l_ee1 f_ee + e5,
        ee2 = l_ee2 f_ee + e6,
        ee3 = l_ee3 f_ee + e7,
        ee4 = l_ee4 f_ee + e8,

        si1 = l_si1 f_si + e9,
        si2 = l_si2 f_si + e10,
        si3 = l_si3 f_si + e11,
        si4 = l_si4 f_si + e12,


        fc1 = l_fc1 f_fc + e13,
        fc2 = l_fc2 f_fc + e14,
        fc3 = l_fc3 f_fc + e15,
        fc4 = l_fc4 f_fc + e16,
        fc5 = l_fc5 f_fc + e17,

        ha1 = l_ha1 f_ha + e18,
        ha2 = l_ha2 f_ha + e19,
```

```
        ha3 = l_ha3 f_ha + e20,
        ha4 = l_ha4 f_ha + e21,

        pv1 = l_pv1 f_pv + e22,
        pv2 = l_pv2 f_pv + e23,
        pv3 = l_pv3 f_pv + e24,

        ai1 = l_ai1 f_ai + e25,
        ai2 = l_ai2 f_ai + e26,
        ai3 = l_ai3 f_ai + e27;
VARIANCE
        f_pe = 1,
        f_ee = 1,
        f_si = 1,
        f_fc = 1,
        f_ha = 1,
        f_pv = 1,
        f_ai = 1,
        e1-e27 = var_e1-var_e27;
*STD
*       f_oc f_js f_si f_ac f_ep,
*       e1-e21 = var_e1-var_e21;
COV
        f_pe f_ee = c_pe_ee,
        f_pe f_si = c_pe_si,
        f_pe f_fc = c_pe_fc,
        f_pe f_ha = c_pe_ha,
        f_pe f_pv = c_pe_pv,
```

```
        f_pe f_ai = c_pe_ai,

        f_si f_ee = c_si_ee,
        f_si f_fc = c_si_fc,
        f_si f_ha = c_si_ha,
        f_si f_pv = c_si_pv,
        f_si f_ai = c_si_ai,

        f_ee f_fc = c_ee_fc,
        f_ee f_ha = c_ee_ha,
        f_ee f_pv = c_ee_pv,
        f_ee f_ai = c_ee_ai,

        f_fc f_ha = c_fc_ha,
        f_fc f_pv = c_fc_pv,
        f_fc f_ai = c_fc_ai,

        f_ha f_pv = c_ha_pv,
        f_ha f_ai = c_ha_ai,

        f_pv f_ai = c_pv_ai;
VAR
        pe1-pe4
        ee1-ee4
        si1-si4
        fc1-fc5
        ha1-ha4
        pv1-pv3
```

```
        ai1-ai3;
run;
```

Model I: Measurement Model Cronbach's Alpha and Exploratory Factor Analysis for Validity

```
proc corr data=main alpha;
        var pe1-pe4;
proc corr data=main alpha;
        var ee1-ee4;
proc corr data=main alpha;
        var si1-si3;
proc corr data=main alpha;
        var fc1-fc4;
proc corr data=main alpha;
        var ha1-ha4;
proc corr data=main alpha;
        var pv1-pv3;
proc corr data=main alpha;
        var ai1-ai3;
run;

proc factor data=pre nfactors=7 rotate=protomax;
        VAR
                pe1-pe4
                ee1-ee4
                si1-si3
                fc1-fc4
                ha1-ha4
```

```
        pv1-pv3
        ai1-ai3;
run;
```

Model II: Modified Measurement Model Analysis

```
proc calis data=final covariance modification;
    LINEQS
        pe1 = l_pe1 f_pe + e1,
        pe2 = l_pe2 f_pe + e2,
        pe3 = l_pe3 f_pe + e3,
        pe4 = l_pe4 f_pe + e4,

        ee1 = l_ee1 f_ee + e5,
        ee2 = l_ee2 f_ee + e6,
        ee3 = l_ee3 f_ee + e7,
        ee4 = l_ee4 f_ee + e8,

        si2 = l_si2 f_si + e9,
        si3 = l_si3 f_si + e10,
        si4 = l_si4 f_si + e11,

        fc3 = l_fc3 f_fc + e12,
        fc4 = l_fc4 f_fc + e13,
        fc5 = l_fc5 f_fc + e14,

        ha1 = l_ha1 f_ha + e15,
        ha2 = l_ha2 f_ha + e16,
        ha3 = l_ha3 f_ha + e17,
```

```
        ha4 = l_ha4 f_ha + e18,


        pv1 = l_pv1 f_pv + e19,
        pv2 = l_pv2 f_pv + e20,
        pv3 = l_pv3 f_pv + e21,


        ai1 = l_ai1 f_ai + e22,
        ai2 = l_ai2 f_ai + e23,
        ai3 = l_ai3 f_ai + e24;
VARIANCE
        f_pe = 1,
        f_ee = 1,
        f_si = 1,
        f_fc = 1,
        f_ha = 1,
        f_pv = 1,
        f_ai = 1,
        e1-e24 = var_e1-var_e24;
*STD
*       f_oc f_js f_si f_ac f_ep,
*       e1-e21 = var_e1-var_e21;
COV
        f_pe f_ee = c_pe_ee,
        f_pe f_si = c_pe_si,
        f_pe f_fc = c_pe_fc,
        f_pe f_ha = c_pe_ha,
        f_pe f_pv = c_pe_pv,
        f_pe f_ai = c_pe_ai,
```

```
        f_si f_ee = c_si_ee,
        f_si f_fc = c_si_fc,
        f_si f_ha = c_si_ha,
        f_si f_pv = c_si_pv,
        f_si f_ai = c_si_ai,

        f_ee f_fc = c_ee_fc,
        f_ee f_ha = c_ee_ha,
        f_ee f_pv = c_ee_pv,
        f_ee f_ai = c_ee_ai,

        f_fc f_ha = c_fc_ha,
        f_fc f_pv = c_fc_pv,
        f_fc f_ai = c_fc_ai,

        f_ha f_pv = c_ha_pv,
        f_ha f_ai = c_ha_ai,

        f_pv f_ai = c_pv_ai;
VAR
        pe1-pe4
        ee1-ee4
        si2-si4
        fc3-fc5
        ha1-ha4
        pv1-pv3
        ai1-ai3;
```

```
run;
```

Model II: Modified Measurement Model Cronbach's Alpha and Exploratory Factor Analysis for Validity

```
proc corr data=final alpha;
        var pe1-pe4;
proc corr data=final alpha;
        var ee1-ee4;
proc corr data=final alpha;
        var si2-si4;
proc corr data=final alpha;
        var fc3-fc5;
proc corr data=final alpha;
        var ha1-ha4;
proc corr data=final alpha;
        var pv1-pv3;
proc corr data=final alpha;
        var ai1-ai3;
run;

proc factor data=final nfactors=7 rotate=varimax;
        VAR
                pe1-pe4
                ee1-ee4
                si2-si4
                fc3-fc5
                ha1-ha4
                pv1-pv3
                ai1-ai3;
run;
```

Model III: Structural Model Analysis

```
proc calis data=final covariance modification;
        LINEQS
                pe1 = l_pe1 f_pe + e1,
                pe2 = l_pe2 f_pe + e2,
                pe3 = l_pe3 f_pe + e3,
                pe4 =       f_pe + e4,

                ee1 = l_ee1 f_ee + e5,
                ee2 = l_ee2 f_ee + e6,
                ee3 = l_ee3 f_ee + e7,
                ee4 =       f_ee + e8,

                si2 = l_si2 f_si + e9,
                si3 = l_si3 f_si + e10,
                si4 =       f_si + e11,

                fc3 = l_fc3 f_fc + e12,
                fc4 = l_fc4 f_fc + e13,
                fc5 =       f_fc + e14,

                ha1 = l_ha1 f_ha + e15,
                ha2 = l_ha2 f_ha + e16,
                ha3 = l_ha3 f_ha + e17,
                ha4 =       f_ha + e18,

                pv1 = l_pv1 f_pv + e19,
                pv2 = l_pv2 f_pv + e20,
                pv3 =       f_pv + e21,

                ai1 = l_ai1 f_ai + e22,
```

```
            ai2 = l_ai2 f_ai + e23,
            ai3 =       f_ai + e24,
      /* paths */
            f_ai = p_pe_ai f_pe + p_ee_ai f_ee + p_si_ai f_si + p_fc_ai f_fc + p_ha_ai f_ha +
p_pv_ai f_pv + d1;
      VARIANCE
            e1-e24 = var_e1-var_e24,
            d1 = var_d1,
            f_pe f_ee f_si f_fc f_ha f_pv;
      COV
            f_pe f_ee = c_pe_ee,
            f_pe f_si = c_pe_si,
            f_pe f_fc = c_pe_fc,
            f_pe f_ha = c_pe_ha,
            f_pe f_pv = c_pe_pv,

            f_si f_ee = c_si_ee,
            f_si f_fc = c_si_fc,
            f_si f_ha = c_si_ha,
            f_si f_pv = c_si_pv,

            f_ee f_fc = c_ee_fc,
            f_ee f_ha = c_ee_ha,
            f_ee f_pv = c_ee_pv,

            f_fc f_ha = c_fc_ha,
            f_fc f_pv = c_fc_pv,

            f_ha f_pv = c_ha_pv;
      VAR
            pe1-pe4
```

```
            ee1-ee4
            si2-si4
            fc3-fc5
            ha1-ha4
            pv1-pv3
            ai1-ai3;
run;
```

Model IV: Modified Structural Model Analysis

```
proc calis data=final covariance modification;
      LINEQS
            pe1 = l_pe1 f_pe + e1,
            pe2 = l_pe2 f_pe + e2,
            pe3 = l_pe3 f_pe + e3,
            pe4 =       f_pe + e4,

            ee1 = l_ee1 f_ee + e5,
            ee2 = l_ee2 f_ee + e6,
            ee3 = l_ee3 f_ee + e7,
            ee4 =       f_ee + e8,

            si2 = l_si2 f_si + e9,
            si3 = l_si3 f_si + e10,
            si4 =       f_si + e11,

            fc3 = l_fc3 f_fc + e12,
            fc4 = l_fc4 f_fc + e13,
            fc5 =       f_fc + e14,

            ha1 = l_ha1 f_ha + e15,
            ha2 = l_ha2 f_ha + e16,
```

```
        ha3 = l_ha3 f_ha + e17,
        ha4 =       f_ha + e18,

        pv1 = l_pv1 f_pv + e19,
        pv2 = l_pv2 f_pv + e20,
        pv3 =       f_pv + e21,

        ai1 = l_ai1 f_ai + e22,
        ai2 = l_ai2 f_ai + e23,
        ai3 =       f_ai + e24,
/* paths */
        f_ai = p_si_ai f_si + p_ha_ai f_ha + d1;
   VARIANCE
        e1-e24 = var_e1-var_e24,
        d1 = var_d1,
        f_pe f_ee f_si f_fc f_ha f_pv;
   COV
        f_pe f_ee = c_pe_ee,
        f_pe f_si = c_pe_si,
        f_pe f_fc = c_pe_fc,
        f_pe f_ha = c_pe_ha,
        f_pe f_pv = c_pe_pv,

        f_si f_ee = c_si_ee,
        f_si f_fc = c_si_fc,
        f_si f_ha = c_si_ha,
        f_si f_pv = c_si_pv,

        f_ee f_fc = c_ee_fc,
        f_ee f_ha = c_ee_ha,
        f_ee f_pv = c_ee_pv,
```

```
            f_fc f_ha = c_fc_ha,
            f_fc f_pv = c_fc_pv,

            f_ha f_pv = c_ha_pv;
        VAR
            pe1-pe4
            ee1-ee4
            si2-si4
            fc3-fc5
            ha1-ha4
            pv1-pv3
            ai1-ai3;
run;
```

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