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Completed Research

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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. 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.

Keywords

Technology acceptance, BYOD, Unified theory of acceptance and use of technology (UTAUT), UTAUT2

Introduction

Employees are increasingly demanding to be allowed to use their 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 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) such as installing special applications or device management software on the personal device 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.

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. While the prior research into technology acceptance provides an appropriate starting point for the development of a model of employee acceptance, it has not be applied or empirically tested in the same manner as suggested by this research. 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 and support the existing technology acceptance literature by applying it to employer control and BYOD.

Theoretical Background

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 hands-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 to install the device management applications. Employee consent to employer control of their personal devices has yet to be fully researched, but several IT behavior models can be used as the theoretical background for predicting employee behavior.

The Unified Theory of Acceptance and Use of Technology (UTAUT) as proposed by Venkatesh, Morris, Davis, and Davis (2003) attempts to build upon and synthesize other models including the influential technology acceptance model (TAM). TAM has been used and applied in a variety of contexts since its inception in 1989 (Davis, Bagozzi, & Warshaw, 1989) and has seen several extensions including TAM2 (Venkatesh & Davis, 2000) and more recently UTAUT. Similarly, UTAUT has been extended by its original, primary author with the addition of several new constructs, all theorized as antecedents of acceptance intention. The updated model is known as UTAUT2 (Venkatesh, Thong, & Xu, 2012). The original UTAUT model distills several different acceptance models into four main constructs that are theorized as antecedents of technology acceptance intentions, which subsequently predicts actual behavior. These antecedents include performance expectancy, effort expectancy, social influence, and facilitating conditions. UTATU2 extended the original model by adding hedonic motivation, price value, and habit, again theorizing these new constructs as influencing behavior intentions. The application of UTAUT has been found fairly consistent and is a good place to start for modeling user acceptance of employer control.

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 associated extensions into acceptance of employer control is appropriate. There appears to be a research gap in employee acceptance of employer control but TAM and UTAUT have been applied to other BYOD related activities including BYOD policy acceptance (Storey, 2017) and employee acceptance of BYOD (Loose, Weeger, & Gewald, 2013).

Model Development

The first construct of the employee acceptance model presented in this research, performance expectancy (PE), 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 is 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.

In its original incarnation effort expectancy (EE), 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, which 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.

This research's third construct is social influence (SI) which has its origins in behavioral theory. The construct of social influence 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., 2003). 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.

The next construct, facilitating conditions (FC), 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. The construct of facilitating conditions 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). Facilitating conditions is adapted for this research as the employee's view of the BYOD technical and managerial support they will receive while complying with the employer's control, which 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.

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., 2003). The first construct from UTAUT2 to be included in this research is termed habit (HA). 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 security policies unrelated to BYOD, they are likely to automatically follow policies requesting control of personally owned devices.

The final construct, which also stems from UTAUT2, is price value (PV). This construct is only relevant when dealing with consumer technology and is the individual's subject 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.

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. Each relationship between the aforementioned constructs and employee acceptance of control forms the basis for each hypothesis. These hypotheses and the associated relationships are summarized in the path model shown in Figure 1.
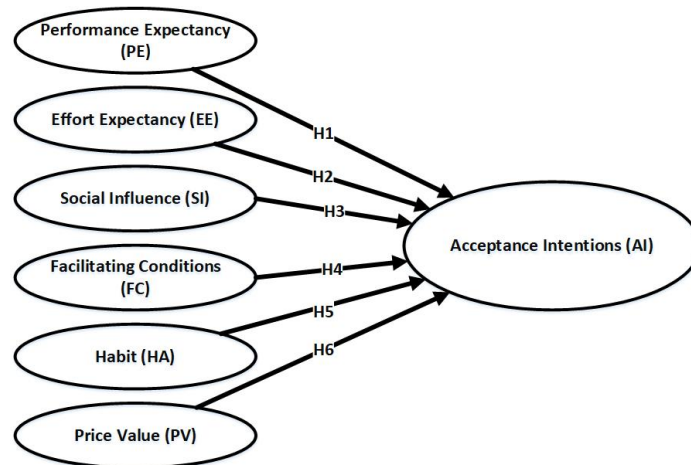
Figure 1. Path Model with Hypotheses

Methodology and Analysis

The model posits six constructs that directly affect an employee's acceptance intentions. To empirically test the hypotheses, structural equation modeling can be applied. To measure the constructs hypothesized in this research, a survey instrument was created based upon measures used in other technology acceptance research. Meaning, each construct is operationalized by examining other research that includes similar constructs and adapting the measures to this research. At least three or four measures were developed for each latent construct to avoid an under-identified model.

The survey was administered using SurveyMonkey, an online survey creation and data collection tool. A combination of two sources were used to find participants for the survey. Firstly, 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). A second group of participants was gathered using a targeted collector provided by SurveyMonkey. Both collection methods sought an all-encompassing sample seeking United States residents over the age of 18. However, it is possible that people outside of the US participated in the survey. To ensure anonymity the survey instrument did not ask for any identifying information including the participant's location or country of origin.

Reddit.com provided 51 participants while SurveyMonkey provided 359 participants for a total of 410 responses. However, after removing responses with missing or incomplete data, a total of 298 responses remained, which neighbors the desired 300 responses (O'Rourke & Hatcher, 2013). These final 298 responses were used for the final data analysis.

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 (Hair, Black, Babin, & Anderson, 2009; O'Rourke & Hatcher, 2013). To that end, the test of model fit, construct reliability (CR), convergent validity, and divergent validity were performed.

Firstly, the degrees of freedom of the model are examined. The model is identified with 231 degrees of freedom which comes from a total of 300 unique moments and 69 parameters. Next, the goodness-of-fit statistics are examined for the measurement model. These statistics are summarized in the middle column of Table 1, found below. 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 ($X2$) is 416.81 and significant. A significant Chi-square 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 0.95 which is above the suggested values for this sample size (Hair et al., 2009).

The SRMR value is slightly above the ideal 0.05 value at 0.053 but is well below the recommended 0.08 with CFI above 0.92 (Hair et al., 2009). The RMSEA is similar with a value of 0.052. This does not quite reach the ideal 0.05 but is still considered satisfactory as it falls below 0.55 (O'Rourke & Hatcher, 2013).

Chi-square (X2)	Measurement Model	Structural Model
Chi-square	416.81	416.82
Chi-square p value	<.0001	<.0001
Degrees of freedom	231	231
Absolute Fit Measures	Measurement Model	Structural Model
Goodness-of-fit index (GFI)	0.90	0.90
Standardized root mean residual (SRMR)	0.053	0.053
Parsimony Fit Indices	Measurement Model	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	Measurement Model	Structural Model
Comparative fit index (CFI)	0.95	0.95

Table 1. Overall Fit Indices for Measurement and Structural Models (values rounded to two decimal places)

Convergent and divergent validity are tested by examining the average variance extracted (AVE), factor loadings, and composite reliability (CR). The AVE and CR statistics are shown in table 2. The AVE values for Social Influence and Facilitating Conditions are a bit lower than desired but the other constructs have acceptable values. The CR statistic surpasses the desired value of 0.7 for each construct.

Factor	Average Variance Extracted (AVE)	Composite Reliability (CR)
Performance Expectancy (PE)	0.69	0.90
Effort Expectancy (EE)	0.60	0.86
Social Influence (SI)	0.48	0.73
Facilitating Conditions (FC)	0.45	0.71
Habit (HA)	0.65	0.88
Price Value (PV)	0.69	0.87

Table 2. Average Variance Extracted and Composite Reliability for each construct (values rounded to two decimal places)

The results of the confirmatory factor analysis are promising and demonstrate the reliability and validity of the survey instrument. The only characteristic where this model deviates from the ideal is in the average variance extracted. Only two constructs are near, but fall short, of the 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.

Structural Equation Modeling

The structural model is used to estimate the relationships between the latent dependent and independent variables. 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 1 above. As can be seen, these values are unchanged. This means that specifying the structural relationship did not negatively impact the overall model fit.

The structural path estimates are summarized in Table 3. 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.

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 3. Standardized Parameter Estimates (* = significant at 95% confidence, ** = significant at 99% confidence, values rounded to two decimal places)

Conclusion

UTAUT has been a popular model for IS research and examining technology acceptance. Additionally, UTAUT is 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 employers to control their personally-owned devices. Only the constructs of 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 first. To support social influence, key individuals and influencers among the organization should actively encourage implementation of any employer control that is needed to ensure the security of the organization's sensitive information. 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 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 of personally-owned devices may build employee acceptance by establishing a pattern of acceptance.

This research is limited in its generalizability by its data collection methodology and sample. Only US computer users 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 models of employee acceptance behavior.

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