AN EMPIRICAL STUDY OF BEHAVIORAL INTENTION TO USE BLOCKCHAIN TECHNOLOGY

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ABSTRACT

This study specifically explores whether user acceptance of blockchain technology can be predicted using the unified theory of acceptance and use of technology model (UTAUT). This model developed by Venkatesh et al. (2003) served as the primary framework. The survey was distributed to students and faculty of a midsize university and IT professionals in several organizations in the Northeast region of the United States, yielding 127 usable survey responses. Results show that perceived operational usefulness has a positive influence on blockchain use, as well as perceived ease of use. Demographics also indicate the potential for growth in blockchain acceptance, including younger generations and IT professionals who could act as early adoption agents.

INTRODUCTION

Originally designed as a system of recording and verifying cryptocurrency transactions, including the popular cryptocurrency Bitcoin, blockchain has been recognized as an adaptable technology that would potentially transform a wide range of industries. If successfully implemented, blockchain may increase financial sector efficiency by eliminating many of the time-consuming manual tasks associated with transaction processing and replacing the need for neutral third-party intermediaries in verifying and executing financial transactions (Dai & Vasarhelyi, 2017; Lewis et al., 2017; White, 2017). It also can provide real-time evidence of the sourcing or flow of materials within supply chains, or enhance the efficiency of cloud-based manufacturing processes (Francisco & Swanson, 2018; Li et al., 2018). Blockchain may even have the potential to automatically enforce debt covenants or remit tax payments through real-time smart contracts and to reshape many of the tasks currently being completed by accountants and auditors (Dai & Vasarhelyi, 2017). The proposed applications seem almost endless.

The numerous applications of blockchain are a result of its unique design. In its most basic form, it is an append-only list of records that is decentralized and managed by all participants in a peer-to-peer network. The records of all participants in the network simultaneously update when a consensus is reached among them, allowing the blocks to effectively function as a decentralized public ledger. Every party in the network receives the new block of information at the same time and stores a copy of it. The append-only characteristic of its form, and the fact that all network participants receive a copy, limits the potential manipulation of data on the blockchain once a record has been added. As a result, blockchain has the potential to enhance data integrity, transparency and security.

If successful at adapting blockchain technology to new industries, early adopters of blockchain technology could establish an important competitive advantage. However, the scarcity of knowledge and an applied understanding of blockchain technology has so far hindered such widespread applications (White, 2017). This study contributes to the existing debate on whether blockchain can be adopted to these applications by examining the factors that influence user acceptance.

User acceptance of blockchain technology can be predicted through the use of various user acceptance models and by specific independent variables that influence user acceptance. Due to the lack of previous research on blockchain acceptance, this study will examine different independent variables to provide empirical results on which of them affect users' intention to use blockchain. Specifically, this empirical study will attempt to find the correlation of seven specific variables: perceived ease of use, trust with stems to privacy and security, facilitating conditions, and perceived operational usefulness, and the intention to use blockchain technology.

LITERATURE REVIEW

We reviewed articles that evaluate the acceptance of previous IT systems as well as those that discuss the intention to use blockchain technology within several industries such as accounting, healthcare, education, government, finance, and manufacturing. While most articles that discuss potential industry applications share highly optimistic perspectives regarding the revolutionary ways that blockchain technology could improve existing operations, the articles also identify concerns and potential limitations that could hinder the rapid adoption of the technology (Dai & Vasarhelyi, 2017; Iansiti & Lakhani, 2017; Lewis et al., 2017; Nakamoto, 2008; Schaupp & Festa, 2018; White, 2017). Collectively, these authors suggest that blockchain technology has tremendous potential, but that the obstacles may result in a limited number of early adopters. Additionally, realizing the technology's full potential could take a protracted period as industries work through the governmental, regulatory, social, legal, and political implications required to replace existing infrastructures. For instance, Jacob (2011) highlights that blockchain technology is so dissimilar to existing banking processes that it does not fit within the current regulatory definitions and may not be successful at complying with the existing regulatory frameworks. Iansiti and Lakhani (2017) even suggest that the adoption of blockchain technology may be analogous to the development of transmission control protocol/internet protocol (TCP/IP), which

revolutionized computer networking, but took many years since its initial introduction in 1972 to gain widespread acceptance.

Despite the inherent challenges, Crosby et al. (2016), Batubara et al. (2018), Nair and Sutter (2018), and Lewis et al. (2017) also describe a number of prominent applications of blockchain technology. Collectively, these authors suggest that despite the challenges, there are tremendous long-term opportunities for blockchain technology including improving the efficiency, trust, and transparency of transactions involved. Jacobs (2011), Stratopoulos and Wang (2018), Venkatesh et al. (2003), Folkinshteyna and Lennon (2016), and Davis et al. (1989) also detail how it is not unrealistic for a revolutionary technology to take time to implement as it develops and gains acceptance.

While these studies are useful at providing insight into the opportunities and constraints on the adoption of blockchain technologies, limited research has been conducted on user acceptance. If blockchain is to be applied to industry applications, we believe that understanding the factors that influence users' intentions to use blockchain is vital to understanding its path toward acceptance. Specifically, no research has explored what independent variables drive users' intentions to use blockchain. Therefore, we rely on established methods that have previously been used to evaluate the acceptance of other innovative technologies.

This paper utilizes the unified theory of acceptance and use of technology (UTAUT) model developed by Venkatesh et al. (2003) to examine how likely users are to accept the emerging blockchain technology. We chose this model because it is widely recognized as an established tool for determining the acceptance and use of innovative technology. UTAUT was developed to improve upon the eight predominant End User IT acceptance models (theory of reasoned action, technology acceptance model, the motivational model, theory of planned behavior, a combination model of technology acceptance and theory of planned behavior, PC utilization model, and the social cognitive theory). An empirical testing by Venkatesh et al. (2003) determined that the unified model explained nearly 70 percent of the variance in usage intention, which was a significant improvement over any of the eight individual models evaluated. Their testing also suggested three direct determinants of intention to use (performance expectancy, effort expectancy, and social influence), two direct determinants of usage behavior (intention and facilitating behavior), and four significant moderating influences (experience, voluntariness, gender, and age) (Venkatesh et al., 2003). In order to explain more effectively the behavioral intention to use blockchain, we have modified UTAUT by putting the trust variable in place of the social influence factor and focusing on perceived operational usefulness for the performance expectancy factor. We believe that this modified UTAUT can best help us identify, evaluate, and understand independent variables that influence users' intention to use blockchain.

DEVELOPMENT OF HYPOTHESES

Naturally inherent attributes of blockchain such as immediate processing and the potential to automatically execute transactions through smart contracts (Lewis et al., 2017; Dai & Vasarhelyi, 2017) seem likely to positively affect the ease of use. We believe that these intrinsic characteristics

may be perceived by users to be improvements on ease of use, and therefore may influence the rate of blockchain acceptance. Thus, perceived ease of use and adaption should have a positive relationship to an individual's intention to use blockchain.

H1: Perceived ease of use has a positive relationship to an individual's intention to use blockchain.

Since the use and acceptance prediction will be focused on a broad audience in many industries, we believe it is necessary to include social influence as another variable in our model. Since blockchain is a revolutionary technology, certain innovation leaders and early adopters may become the catalysts to lead the widespread acceptance of blockchain. Early adopters of technology may act as role models and spokespeople who will vouch for and legitimize the technology (Venkatesh et al., 2003). Another perspective of the social influence of blockchain technology is that of social ethics and responsibility. Blockchain offers enhanced trust, security, privacy, and other factors in which society can benefit by bridging the trust gap between individual users and business entities in processes that are currently operated away from the public view.

Our second proposed hypothesis is that we believe that "trust, privacy, and security" has a positive relationship to an individual's intention to use blockchain. Blockchain is a shared distributed ledger used in a network to record and verify transactions by a consensus mechanism that creates trust in the network. Gefen et al. (2003) recognized that trust and security are significant factors for the acceptance of e-commerce technologies, and that trust is enhanced by the belief that there are safety mechanisms built into technology platforms. The trust and transparency of transactions could transform the way business transactions occur in the future. We hypothesize that users are more likely to use blockchain if they trust the technology.

H2: Trust has a positive relationship to an individual's intention to use blockchain.

Our third hypothesis is that users consider cost as a very important factor in their intention to use blockchain. We theorize that cost has a negative relationship to an individual's intention to use blockchain. We attribute the negative relationship to the lack of knowledge of what blockchain is and the costs associated with the ledger.

H3: Cost has a negative relationship to an individual's intention to use blockchain.

Facilitating Conditions is tied heavily into user intention (Venkatesh et al., 2003). Therefore, this study hypothesizes that facilitating conditions has a positive relationship to an individual's intention to use blockchain.

H4: Facilitating conditions have a positive relationship to an individual's intention to use blockchain.

Users consider operational usefulness as another very important factor and operational usefulness will have a positive influence on intention to use. What we discovered from the Venkatesh et al. (2003) study is that perceived usefulness is often used to predict user's acceptance to try a new technology.

H5: Perceived operational usefulness has a positive relationship to an individual's intention to use blockchain.

METHODOLOGY

Perceived Ease of Use

This variable is the perceived simplicity that a user holds about using a technology. The Davis et al. (1989) longitudinal study aimed to explain user behavior in accepting innovative computer systems and found that although this variable is less powerful than perceived usefulness, it still influenced the users' intention to use the technology. Since many of the proposed applications of blockchain are outside of the familiarity of existing legacy systems familiar to users, we believe the perceived ease of use to also be relevant to the acceptance of blockchain technology. To measure the perceived ease of use construct, we modified items on the effort expectance construct in Venkatesh et al. (2012) as follows:

Q1: Learning how to use blockchain is easy for me.
Q2: My interaction with blockchain is clear and understandable.
Q3: I find blockchain easy to use.
Q4: It is easy for me to become skillful at using blockchain.

Operational Usefulness

For our research, operational usefulness is technically a new and unused variable in any relevant studies. For the sake of this study, we are considering this variable as related to perceived usefulness. A critical aspect in predicting use is the perceived value that blockchain brings to improving legacy systems. Folkinshteyna and Lennon (2016) suggested that Bitcoin served such a function following the 2008 financial crisis by providing an alternative to the banking system that had suffered a loss of public trust. Also, Davis et al. (1989) combined the traditional TAM and TRA models in an effort to explain intention to use new technology using data from a sample of MBA students at a predominant university. As seen in both models, usefulness was the key factor in predicting use of an IT system. Similarly, we believe that the overall usefulness of blockchain will ultimately determine acceptance and diffusion of the technology. To measure the operational usefulness construct, we modified items on performance expectance from Venkatesh et al. (2012) as follows:

Q17: I find blockchain useful in my daily life.
Q18: Using blockchain increases my chances of achieving things that are important to me.
Q19: Using blockchain helps me accomplish things more quickly.
Q20: Using blockchain increases my productivity.

Facilitating Conditions

Facilitating conditions is a variable chosen due to the nature of blockchain. As seen in the study from Venkatesh et al. (2003), the facilitating conditions variable is tied heavily into user intention. If a potential user feels that the amount of time, effort, and feasibility risk is too high, the user may become turned off from the prospect of using a modern technology. The conditions must be within a manageable range, so that the implementation of blockchain will be perceived as useful. To measure the facilitating conditions construct, we modified items on the facilitating conditions construct in Venkatesh et al. (2012) as follows:

Q13: I have the resources necessary to use blockchain.
Q14. I have the knowledge necessary to use blockchain.
Q15. Blockchain is compatible with other technologies I use.
Q16. I can get help from others when I have difficulties using blockchain.

Trust

Trust, defined by the extent to which the users feel confident that a system such as blockchain, will operate on par to its claimed key attributes on a consistent basis. Since blockchain's primary application is currently that of transaction management, one key aspect that is considered is the role that evolving government regulations can have on influencing the level of trust that users have in the technology. While government regulatory oversight on blockchain applications may slow the rate at which it is applied to additional applications, it also presents the opportunity to gain public trust through legitimacy of being recognized and scrutinized by established governmental regulatory agencies. Consumers often feel more comfortable using technologies that are vetted by trusted third parties to manage personal information, finances or other sensitive information. The guidance provided by government agencies such as the Securities and Exchange Commission or Federal Trade Commission may also assist in promoting the adoption of the technology in the United States and similar economies because the agencies themselves are trusted by customers (Crosby et al., 2018). Additionally, we would expect trust in blockchain to increase as users begin to understand the distributed nature of blockchain recordkeeping and the limited ability to alter prior blocks. To measure the trust construct, we modified items on the trust variable in Wu et al. (2012) as follows:

Q8: Even if not monitored, I would trust blockchain to do the job right.
Q9: I trust that blockchain protects personal information.
Q10: I believe that blockchain is trustworthy.

Security

We hypothesize that trust is dependent on security and privacy. The security variable is measured by the following items from Wu et al. (2012):

Q5: Blockchain explains that the domain takes some steps to provide security for
    personal information that has been collected.
Q6: Blockchain informs that any personal information will not be disclosed to third party.
Q7: Blockchain has the advanced technology to protect your personal information.

Privacy

We hypothesize that privacy matters in building the trust in blockchain as well. The privacy variable is measured by the following items from Kim and Tadisina (2010):

Q21: I believe that blockchain is eager to provide mechanisms for safe and reliable transactions.
Q22: I believe that blockchain is honest with customers all the time.
Q23: I believe that blockchain is interested in customers' welfare.
Q24: I believe that blockchain does its best to protect customers' welfare.

Cost

The refined Delone and McLean (2003) Information System Success Model has been widely used as a tool for measuring the success of e-commerce technologies. In the model, cost savings is also used as a part of the evaluation of net benefits (Delone & McLean, 2003). Similarly, we believe that the cost variable can possibly hold a negative value on the intention to use blockchain. Since this framework is still being understood on a broad scale, it is assumed that the cost to implement blockchain to replace existing technologies will be substantial. Furneaux and Wade (2011) suggest that the high cost of investing in existing systems will also increase the reluctance to discontinue their use. To define expected operational support costs of blockchain technologies, we modify items on the support cost variable in used by Furneaux and Wade (2011) as follows:

Q11: Supporting the ongoing use of blockchain is costly.
Q12: The ongoing operational costs of blockchain are high.

This study proposes to build two models: a trust model and an intention to use model. Multiple regression models will be utilized. First, this study proposes to build a trust model. In this model the dependent variable is trust, while the independent variables are security and privacy. The regression formula for this model is as follows:

$$X_3 = \beta_0 + \beta_2 X_2 + \beta_7 X_7 + \varepsilon$$

where X_3 = Trust
X_2 = Security
X_7 = Privacy

The second model will employ regression analysis to determine the effect that independent variables, perceived ease of use (X_1), trust (X_3), support cost (X_4), facilitating conditions (X_5), and perceived operational usefulness (X_6) have on the dependent variable, intention to use (Y_1). The regression model is as follows:

$$Y_1 = \beta_0 + \beta_1 X_1 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \varepsilon$$

where Y_1 = Intention to Use
X_1 = Perceived Ease of Use
X_3 = Trust
X_4 = Support Cost
X_5 = Facilitating Conditions
X_6 = Perceived Operational Usefulness

RESULTS

Descriptive Statistics

The survey questionnaire was constructed based on the prior studies (Venkatesh et al., 2003; Wu et al., 2012; Furneaux & Wade, 2011; Davis et al., 1989; Kim & Tadisina, 2010; Lee et al., 2007) in line with the research hypotheses. Surveys were administered at a business school in a mid-sized public university in the Northeast region of the United States. In addition, the surveys were electronically distributed to IT professionals at several organizations in a nearby city in the same state as the university. If a response was incomplete with multiple missing values, it was discarded. Our sample data includes 127 usable survey responses.

Descriptive statistics indicate a fairly even distribution between undergraduate students (43.3 percent) and individuals with blockchain education/IT professionals/MIS majors (59.9 percent). Descriptive statistics also indicate that 36.1 percent of the respondents had less than a 4-year college degree while 59.1 percent of the respondents had at least a 4-year college degree. 4.7 percent did not indicate their level of education. The majority (77.2 percent) of the respondents were less than 35 years old. 18.0 percent were at least 35 years old and 4.7 percent of respondents did not indicate their age. The mean age for all respondents was 32.76 years old. Males represent 58.3 percent of the respondents and females represented 37.0 percent of the respondents. 4.7 percent of respondents did not indicate their gender.

TABLE 1. SAMPLE DATA

Affiliation	Frequency	Percentage
Undergraduates	55	43.3
MBA with Blockchain Education	29	22.8
IT Professionals and MIS Majors	42	33.1
Other	1	0.8
Education Level		
Some High School	1	0.8
High School Graduate	1	0.8
Some College	34	26.8
2 Year College Degree	10	7.9
4 Year College Degree	63	49.6
Master's Degree	11	8.7
Doctorate	1	0.8
Missing/Preferred Not to Answer	6	4.7
Age Range		
18 – 22	58	45.7
23 – 34	40	31.5
35 – 44	14	11.0
45 – 54	5	3.9
55+	4	3.1
Missing/Preferred Not to Answer	6	4.7
Gender		
Female	47	37.0
Male	74	58.3
Missing/Preferred Not to Answer	6	4.7
Total	127	100.0

The descriptive statistics of the eight constructs are shown in Table 2.

TABLE 2. DESCRIPTIVE STATISTICS OF CONSTRUCTS

Construct	N	Min.	Max.	Mean	Std. Dev.	Skewness		Kurtosis	
						Statistic	S.E.	Statistic	S.E.
Ease of Use (X_1)	127	1.00	7.00	3.5413	1.45936	.105	.215	-.417	.427
Security (X_2)	127	1.00	7.00	4.3163	1.49806	-.345	.215	-.188	.427
Trust (X_3)	127	1.00	7.00	4.1168	1.49651	-.370	.215	-.267	.427
Cost (X_4)	127	1.00	6.67	3.7703	1.18633	-.198	.215	.086	.427
Facilitating (X_5)	127	1.00	7.00	3.6939	1.47916	.021	.215	-.583	.427
Usefulness (X_6)	126	1.00	7.00	3.4577	1.37383	.113	.216	-.223	.428
Privacy (X_7)	126	1.00	7.00	4.1111	1.26038	-.311	.216	.536	.428
Intention (Y_1)	127	1.00	7.00	3.9993	1.41805	-.116	.215	-.250	.427
Experience	126	1.00	7.00	5.0132	1.41509	-.706	.216	.203	.428

The proposed constructs include one dependent variable (Y_1, intention to use) and seven independent variables (X_1 to X_7), and an experience demographics variable. Cronbach's Alpha was utilized to measure the reliability of the proposed constructs. A reliability coefficient of 70.0 percent or higher is considered acceptable. Based on the results of Cronbach's Alpha, we concluded that our survey questions are reliable since all results are greater than 70.0 percent. The results are illustrated in Table 3.

TABLE 3. RELIABILITY ANALYSIS

Scale	Items	Cronbach's Alpha
Perceived Ease of Use (X_1)	Q1 – Q4	93.2%
Security (X_2)	Q5 – Q7	89.2%
Trust (X_3)	Q8 – Q10	91.4%
Cost (X_4)	Q11 – Q12	92.0%
Facilitating Conditions (X_5)	Q13 – Q16	87.4%
Operational Usefulness (X_6)	Q17 – Q20	91.2%
Privacy (X_7)	Q21 – Q24	89.5%
Intention to Use (Y_1)	Q25 – Q28	91.4%
Experience	Q29 – Q31	88.9%

We ran a t-test to determine if the differences between female and male responses to our survey questions are statistically significant. Results indicate that ease of use is statistically significant between females and males (p=0.037) and that males perceive blockchain as easier to use than females. Security is marginally significant between females and males (p=0.054). Males appear to trust blockchain technology more than females, but their differences are not significant (p=0.181). Males also appear to perceive blockchain as costlier than females, but their differences are insignificant (p=0.101). Facilitating conditions is marginally significant between females and males (p=0.076). Males believe that they are better equipped to use blockchain technology than females. Perceived operational usefulness is not statistically significant between females and males (p=0.032). Privacy is marginally significant (p=0.078). Males appear to believe that blockchain will protect user privacy more than females. Intention to use is statistically significant between males and females (p=0.002). Experience construct shows that males display more experience with blockchain than females (p=0.014). The t-test results are illustrated in Table 4.

TABLE 4. T-TEST RESULTS BY GENDER

Scale	Gender	N	Mean	Std. Dev.	df	t	p
Ease of Use	Female	47	3.2021	1.39354	119	-2.115	0.037
	Male	74	3.7736	1.48288			
Security	Female	47	4.0177	1.42198	119	-1.950	0.054
	Male	74	4.5541	1.50724			
Trust	Female	47	3.9433	1.52961	119	-1.345	0.181
	Male	74	4.3131	1.43715			
Cost	Female	47	3.5745	1.20927	119	-1.655	0.101
	Male	74	3.9392	1.16375			
Facilitating Conditions	Female	47	3.4149	1.26971	119	-1.792	0.076
	Male	74	3.9071	1.58736			
Operational Usefulness	Female	46	3.1250	1.12885	119	-2.172	0.032
	Male	74	3.6745	1.46634			
Privacy	Female	46	3.8804	1.26022	119	-1.779	0.078
	Male	74	4.2973	1.24050			
Intention to Use	Female	47	3.5230	1.21120	119	-3.169	0.002
	Male	74	4.3288	1.45099			
Experience	Female	47	4.6028	1.51105	119	-2.500	0.014
	Male	74	5.2523	1.31241			

We also ran a t-test to determine the difference between the responses from respondents with at least a 4-year college degree. Results indicate that ease of use is statistically significant between respondents with at least a 4-year college degree and respondents with less than a 4-year college degree (p=0.001). More educated respondents perceive that blockchain technology is more secure than less educated people, but their differences are not statistically significant (p=0.130). Trust, cost, and facilitating conditions factors are marginally significant between two groups (p<0.10). Perceived operational usefulness and privacy factors are statistically significant (p<0.05), while the intention to use is not statistically significant between the two groups (p=0.180). People with more education show significantly more technology-related experiences than less educated people (p=0.006).

We performed a bivariate correlation analysis between variables, and ran a Pearson correlation test. Evidence shows the dependent variable (intention to use) and all independent variables appear to be strongly correlated. Table 5 reports Pearson correlation results.

TABLE 5. PEARSON CORRELATIONS

	X_1	Y_1	X_6	X_2	X_3	X_4	X_5	X_7	Exp.
Ease of Use (X_1)	1	.542**	.561**	.307**	.366**	.269**	.552**	.256**	.352**
Intention to Use (Y_1)		1	.631**	.584**	.564**	.438**	.652**	.589**	.412**
Usefulness (X_6)			1	.563**	.624**	.437**	.676**	.580**	.306**
Security (X_2)				1	.803**	.399**	.561**	.750**	.437**
Trust (X_3)					1	.424**	.586**	.786**	.367**
Cost (X_4)						1	.587**	.441**	.361**
Facilitating (X_5)							1	.534**	.355**
Privacy (X_7)								1	.385**
Experience									1

** p<0.01 (1-tailed)

We ran a multiple regression analysis. We initially ran a model to determine whether security and privacy were strong predictors of trust. Residual analysis was also run through SPSS to look for outliers. The Casewise Diagnostic test for our initial model indicated an outlier issue with case number 107 and 74, so we excluded the two sample cases. We reran the model for our analysis. Our second model had no issues with outliers. Results indicate a strong statistical significance in the multiple regression model on trust [Adjusted R^2 = .743; $F(2, 121) = 178.930$; p<.001]. The two

predictors, security and privacy account for 74.3 percent of variance in trust. Findings show that security and privacy (p<0.01) significantly affect trust. There is no evidence of serious multicollinearity in the model. Variance Inflationary Factors (VIF) for all variables are less than four. The trust model results show in Table 6.

TABLE 6. TRUST MODEL

	Dependent Variable = Trust				
	Adjusted $R^2 = 0.756$; $F(2, 121) = 191.991^{***}$				
	B	SE	Beta	t	VIF
Constant	-.039	.224		-.172	
Security	.466	.066	.477	7.084***	2.293
Privacy	.524	.078	.455	6.744***	2.293

Note: * p<0.05, ** p<0.01, *** p<0.001

B refers to unstandardized regression coefficient

SE refers to standard error

Beta refers to standardized regression coefficient

We ran a regression analysis on a full model including all independent variables. The overall model shows statistical significance, but only the experience variable is significantly related to the intention to use blockchain (p=0.021). Trust is marginally significant (p=0.088). The full model presents serious multicollinearity. High VIFs are reported on two predictors: usefulness (5.166) and facilitating conditions (4.079). Table 7 shows the full model results.

TABLE 7. FULL MODEL

		Dependent Variable = Intention to Use			
		Adjusted R^2 = 0.524; $F(6,116) = 23.421$**			
	B	SE	Beta	t	VIF
(Constant)	.253	.388		.653	
Ease of Use	.168	.110	.173	1.523	3.316
Usefulness	.227	.147	.220	1.552	5.166
Facilitating	.132	.122	.137	1.086	4.079
Cost	.115	.102	.093	1.134	1.720
Trust	.142	.082	.146	1.721	1.849
Experience	.170	.072	.166	2.348*	1.284

*$p<0.05$, **$p<0.01$

We next ran numerous models to determine the best-fit model for predicting the intention to use blockchain. Based on our analysis, a regression model with five variables appears to be best fit the sample data [Adjusted R^2 = 0.524; $F(5, 117)$= 27.826; $p<0.001$]. Findings show that usefulness (p=0.007) and experience (p=0.020) significantly affect intention to use. Trust variable shows moderate significance (p=0.058) and cost variable marginally affects intention to use (p=0.077). Ease of use variable only shows no significance. There is no evidence of serious multicollinearity in the model. VIF for all variables are less than four. Table 8 shows the best-fit model for behavioral intention to use blockchain.

TABLE 8. BEST-FIT BEHAVIORAL INTENTION MODEL

	B	SE	Beta	t	VIF
Dependent Variable = Intention to Use					
Adjusted R^2 = 0.524; $F(5, 117)$= 27.826**					
(Constant)	.190	.395		.479	
Trust	.156	.081	.160	1.912	1.805
Ease of Use	.158	.110	.164	1.443	3.297
Usefulness	.323	.117	.313	2.758**	3.297
Cost	.163	.092	.131	1.781	1.396
Experience	.171	.072	.167	2.365*	1.283

*$p<0.05$, **$p<0.01$

Reduced regression models were run to determine if the control variables such as gender, age, education level matter. We investigated whether the intention to use was different among various groups of users. We gathered interesting findings from reduced models for males only, young adults only, and millennials only. A reduced model for males only shows statistical significance in [Adjusted R^2 =0.533; $F(4, 69)$ = 21.830; $p<0.001$]. Findings show that facilitating conditions ($p<0.01$) and ease of use ($p<0.05$) significantly affect males' intention to use. Trust and cost show no significant relationship. There is no evidence of serious multicollinearity in the model. Table 9 reports the male model.

TABLE 9. REDUCED MODEL – MALES ONLY

Dependent Variable = Intention to Use			
Adjusted $R^2 = 0.533$; $F(4, 69) = 21.830^{***}$			
	B	SE	Beta	t
Constant	.810	.484		1.673
Ease of Use	.283	.109	.289	2.597*
Trust	.106	.103	.105	1.028
Facilitating	.345	.115	.378	2.998**
Cost	.164	.125	.132	1.313

*p<0.05, **p<0.01, ***p<0.001

Results indicate statistical significance in the reduced model for young adults [Adjusted R^2 = .421; $F(4, 53) = 11.374$; p < 0.001]. Facilitating conditions (p<0.01) and trust (p<0.05) significantly affect respondents (ages 18 to 22) on their intention to use. Ease of use and cost show no significance. There is no evidence of serious multicollinearity in the model. Table 10 reports the young adult model results.

TABLE 10. REDUCED MODEL – YOUNG ADULTS ONLY

Dependent Variable = Intention to Use (Age: 18 - 22)			
Adjusted $R^2 = 0.421$; $F(4, 53) = 11.374^{**}$			
	B	SE	Beta	t
Constant	1.662	.434		3.827
Ease of Use	.121	.117	.133	1.032
Trust	.298	.120	.358	2.481*
Facilitating	.343	.122	.395	2.814**
Cost	-.195	.119	-.199	-1.641

*p<0.05; **p<0.01

Results indicate statistical significance in the reduced model for millennials [Adjusted R^2 = .526; $F(4, 58)$ = 18.184; $p < 0.001$]. Findings show that cost significantly affects the millennials (ages 23 – 34 years old) on their intentions to use blockchain. Ease of use variable moderately affects intention to use ($p < 0.10$). Trust and facilitating conditions show no significant relationship. There is no evidence of serious multicollinearity in the model. Table 11 reports the millennial model.

TABLE 11. REDUCED MODEL – MILLENNIALS ONLY

| | | Dependent Variable = Intention to Use (Age: 23 – 34) | | |
| | | Adjusted R^2 = 0.526; $F(4, 58)$ = 18.184** | | |
	B	SE	Beta	T
Constant	.382	.539		.709
Ease of Use	.298	.155	.288	1.918
Trust	.146	.115	.144	1.272
Facilitating	.239	.149	.243	1.598
Cost	.294	.146	.223	2.006*

*$p < 0.05$, **$p < 0.01$

DISCUSSION

First, we hypothesize that the perceived ease of use will have a positive influence on the intention to use. At an objective level, the evidence gathered via data analysis does not support our hypothesis, though this hypothesis has the second highest strength of correlation. We attribute these results due to the fact that blockchain is a very new concept and has not yet become widely understood by general users. This adds a level of uncertainty of how to utilize blockchain technologies. We believe that this evidence likely will hold true for blockchain diffusion until newer applications of the framework become more prevalent and user friendly, such as how perceived usefulness and ease of use motivated the acceptance and dispersion of multimedia messaging service (MMS) (Lee et al., 2007) and other new technologies that have gained acceptance by general users.

Second, we hypothesize that trust will have a positive correlation on intention to use. The evidence from our models shows that there is no significant correlation between the two and that our data does not support this hypothesis. This is likely due to the lack of understanding of not only blockchain technology, but information security as a whole by the general population. While almost every aspect of modern society is dominated by technology, it can be safely assumed that

technical literacy is not common amongst the general population. While information protection, security, and technology trust are in the forefront of many individual's consciousness when dealing with technology, the technical attributes may not be fundamentally understood. We believe that since blockchain is an advanced and fairly new technology, many potential users cannot compare and contrast blockchain with current/standard network security characteristics. This sophomoric understanding may hinder the importance rating of blockchain, which would create results that we have found in our models. With a better education of the potential security offerings of blockchain, we believe that our tools can better predict usage, as seen in previous studies such as with Schaupp and Festa (2018). They examined the intention to use blockchain's applications to cryptocurrency, utilizing the theory of planned behavior. Using linear regression, they found that the intent to use blockchain is related to favorable attitudes, subjective norms and perceived behavioral control.

Third, we hypothesize that cost has a negative impact on the intention to use blockchain. One surprising finding from our data came in the form of this hypothesis. The data collected from our model shows that there is a weak correlation between the two variables, but it is still a positive factor. We attribute this finding to the fact that the sample participants may feel that though the cost of utilizing blockchain will be fairly large in the initial phases, the benefits may be worth it in the future. As with other variable items, we believe that as blockchain technology matures and grows, the general population will become more educated and more literate which will greatly improve the numbers.

Fourth, we hypothesize that facilitating conditions has a positive influence on intent to use. All of the hypotheses set forth by our group in one way or another deal with a direct concept such as trust, ease of use, and perceived usefulness. These factors are strong indicators of acceptance, but one downside they share is that those concepts are evaluated in isolation. We measured facilitating conditions in order to see how the readiness of an organization/individual from a readiness standpoint affects intent to use. Facilitating conditions seemed to affect trust and experience the most from the data we gathered from the sample. We believe this is in part due to the fact that if a user feels that their organization is not ready to adapt logistically, then they will not trust blockchain and its potential.

Lastly, we hypothesize that operational usefulness will have a positive influence on intention to use. The evidence gained in conducting our analysis provided inconclusive and mixed results. Our results show that the statistic proving correlation was at a relatively neutral level, thus barring our group from conclusively determining whether or not it supports or does not support our claim. Though we must conclude that the evidence is inconclusive due to standard statistical practice, we may assert that this variable plays the largest part in predicting intention to use outside of demographic factors due to it holding the highest statistical value (p=0.652). This aligns with previous studies in which a common construct, perceived usefulness, is often used to predict acceptance (Venkatesh et al., 2003). We attribute this to the basic theory of cost benefit analysis, in which even though an individual may not understand a certain technology, they will ultimately be open to the idea if it provides a level of inherent value to their lives.

Managerial Implications

Due to these results, there are several managerial implications that may be asserted. Most of our factors (variables) hold a neutral to negative contribution value to the acceptance and intent to use blockchain. This leads us to conclude that most end users will have a challenging time in embracing this new framework.

In order to accommodate the transition, respective organizations will face both direct and indirect costs stemming from change management controls: hiring subject matter experts, educational programs, HR specialists, pilot programs, etc. These measures are key to aiding in the implementation of blockchain throughout an organization. Initiatives like these must be accounted for when determining the cost to benefit ratio of adapting blockchain.

Our results shed light to a strategic path in which managers may exploit to increase the probability of blockchain acceptance and use. In the three reduced models, the results indicated that three demographic groups hold a slightly positive correlation of acceptance (males, ages 18-22, and ages 23-35). In the introduction of blockchain, high-level decision makers should exploit these three demographic groups. The targeted groups of individuals are the early adopters and innovators in which lead the way in acceptance and usage intention. Just like most technological advances, early adopters are the intricate group of people to initially pilot that technology. By introducing blockchain to these groups of individuals, managers should utilize them as a pilot/Beta participant pool, gaining significant constructive feedback on the new blockchain application. By doing so, the decision makers will gain critical insight which should be used to tweak that application of blockchain for the future use and innovation.

While this study provided a set of initial results that can aid managers in a current setting, this newly created tool presents itself as a valuable tool for future research. The development and understanding of blockchain is perpetually growing and in turn a greater number of professionals and students are becoming more knowledgeable in the technology. As this cycle progresses, our model will become more valuable since the primary roadblock in producing solidified data was a lack of general blockchain literacy.

CONCLUSION

This paper successfully applied the UTAUT model to evaluate users' acceptance of blockchain technology. This study performed multivariate statistical models to evaluate seven variables and the acceptance of blockchain technology. Despite the technological potential of blockchain adoption to revolutionize applications across industries, early adoption seems far from certain. Most of the variables held a neutral to negative contribution value to the acceptance and intention to use blockchain. However, the results showed that perceived operational usefulness has a positive influence on blockchain use, as well as perceived ease of use.

Future research can produce a greater level of accuracy with several enhancements. First, our participant pool was a combination of undergraduate students, MBA students, and an array of working professionals. Researchers should aim to distribute the questionnaire to a technically stronger audience such as IT professionals in the networking, finance, architecture, and infrastructure roles as well as graduate students in similar fields. Second, one problem many researchers face with anonymous questionnaires is the validity of the participant answers. Some data may be unreliable due to a lack of incentive or a general lack of integrity of item answers. Managers may take steps to improve on this, which may shift results. Third, the common trend while studying modern technologies such as blockchain is a lack of understanding. Survey participants may often feel required to answer each item with no base of understanding to guide their answer which can greatly affect the data. Managers can provide a brief educational session to provide some level of reference for the participants in order to make a better guided and valid response.

Due to our results, there are several managerial implications that may be considered. While the existing literature suggests that many functions across industries could benefit from the improved efficiencies of blockchain technology, many users may resist using blockchain applications or delay their implementation when they first become available. In order to accommodate the transition, managers may benefit from promoting the usefulness of the technology and operational utility to encourage employees to embrace it. Additionally, managers may benefit by demonstrating the effectiveness of the new technologies with younger individuals and IT professionals who could act as early adoption agents.
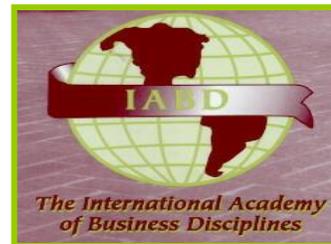
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