International Journal of
INTELLIGENT SYSTEMS AND APPLICATIONS IN ENGINEERING
ISSN :2147-6799 www.ijisae.org Original Research Paper

Examining Factors Influencing Blockchain Technology Adoption in Air Pollution Monitoring

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Submitted: 12/11/2022 **Accepted**: 13/02/2023

Abstract: This study examines key factors that affect blockchain technology adoption used for air pollution monitoring. The proposed system is based on 'IoT'(Internet of Things) and 'Blockchain' technology. It will be highly useful in monitoring and storing air pollution data of cities and of areas densely populatedby factories. Similar existing systems are mostly based on architectures that are centralized and involve human interaction to retrieve data. Most of them take up alot of space and require a high amount of power supply. The proposed pollution monitoring system is leveraging on IoT sensors for data retrieving and storing, which can be designed to fully decentralize the system by using the NEM Blockchain technology. A mixed method is utilized for this research which consists of both quantitative and qualitative data collection tools from the selected participants. The study uses both qualitative in-depth interviews and quantitativeresearch techniques to capture the data and processes that are significant to users in their assessment of Blockchain technology in tracking pollution. The purpose of the research is threefold; to identify the factors determining the willingness of thepublic to use Blockchain technology in monitoring air pollution, to examine the extent to which these factors affect Blockchain technology adoption, and to develop a Blockchain-powered air pollution monitoring system that will resolve the existing problems in the society. Assuming that most innovations considered till now comprise business-related devices, the current study will obtain a trial based model in an alternate setting and add to the existing knowledge base regarding the adoption determinants of Blockchain air pollution monitoring system.

Keywords: *Blockchain technology, Technology Acceptance Model (TAM), Airpollution monitoring systems*

1. Introduction

Environmental pollution has been a factor of apprehension for decades now. Millions of people all over the globe are being gravely affected by air pollution. In support of this observation, the annual State of Global Air Report published by the Health Effects Institute (HEI) found that over 95 per cent of the world's population is breathing unhealthy air (Stateof Global Air Report, 2017). Air pollution is presently the fourth-most elevated reason for death around the world, poorer countries being the most affected and harmful dimensions of contamination result in every year to the early demise of an expected 7 million individuals (World Health Organization report, 2018). Every year, outdoor air pollution causes 3.3 million premature deaths worldwide and if left unattended it is estimated that the deaths toll will double by the year 2050 (Lelieveld et al, 2015). Despite the fact that some worldwide agencies or even government and public initiatives demonstrated much effort in defending the Earth from human-action stimulated natural issues, still, there is a requirement for an automated procedure of checking quality of the air and to use the results of monitoring as an initiative against pollution creators.

Lately, in order to deliver air quality, a rising tendency of using a substitute monitoring option of next generation air sensors is being ovserved (Kumar, 2015; Piedrahita, 2014). New technologies incorporate useful benefits like compact size, cost efficiency and low power consumption which are far more attractive and practical to use rather than traditional systems (Kumar, 2015; Snyder 2013). There are a few disadvantages of the existing monitoring systems such as- the cost, mobility, weight and size of the equipment (Yi et al, 2015). Technology is the key to solving the above problems. This paper proposes a Blockchain Technology (BCT) based solution which, currently is considered a revolutionary discovery, that could improve many daily activities and business processes in various areas of

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application, for example, to record election votes, ensure transparency in accounting, track property rights of luxury items, intellectual property rights (Zile & Strazdina, 2018). Application of this Blockchain technology in air pollution monitoring can make a huge difference because it is inexpensive, portable and simple and does not require huge infrastructure and is publicly accessible.

In this study, we have identified key factors that influence people's willingness to use Blockchain technology to monitor air pollution using the "Technology Acceptance Model" (TAM), which was presented by Fred Davis in 1989. TAM was a technological adaptation of the "Theory of Reasoned Action" (TRA) developed in 1975 by Fishbein and Ajzen. Venkatesh and Davis (2000) proposed a modified version - TAM 2, which theorizes "users' mental assessment of the match between important goals at work and the consequences of performing job tasks". Finally, Venkatesh and Bala (2008) combined both TAM2 and the determinants model of "perceived ease of use" (Venkatesh, 2000) and developed an "integrated model of technology acceptance" known as TAM3. This model linked "the perceived ease of use to perceived usefulness, computer anxiety to perceived ease of use, and perceived ease of use to behavioural intention". However, the practical application of this model is restricted because of the limited number of independent variables considered. In this work, we address the issue of this gap in literature by adding more relevant IT independent variables to quantify this study.

This research aims to develop the instrument dimensions of Blockchain technology adoption in tracking air pollution by modifying the TAM 3 model (Venkatesh & Bala 2008) to consider the data and processes that are significant to the users and the government. The independent constructs for this study are security and information. The dependent constructs for this study are perceived ease of use, behaviour intention, perceived usefulness, and user satisfaction. To demonstrate the effectiveness of the research model, a quantitative questionnaire method was used to collect data from 100 selected graduates from Malaysia. To assess the validity and reliability of the measurement model, "Confirmatory Factor Analysis" (CFA) was conducted, and for examining the research model the "Structural Equation Modelling" (SEM) technique was used. The assessment outcomes provide a valuable reference for government agencies as well as researchers interested in the latest technology adoptions.

The purpose of the research is threefold. First, it intends to identify the factors influencing the willingness of the public to use Blockchain technology in monitoring air pollution. Second, it aims to examine the extent to which these factors affect Blockchain technology adoption. Finally, it plans to propose a Blockchain-powered air pollution monitoring system that will resolve existing problems in the society. Provided that most innovations considered till now comprise business-related devices, this study will establish a trial of the said model in an alternate setting and add to the knowledge base regarding the acceptance determinants of Blockchain air pollution monitoring system.

2. Literature Review

2.1 Evolution of Tam Model

The "Technology Acceptance Model" (TAM) was developed to address a key problem related to the field of information technology. The study's primary objective was to assess why performance gains were often inhibited or obstructed by a user's unwillingness to accept new technology (Davis, 1989). TAM was an adaptation to the Theory of Reasoned Action (TRA) of Fishbein and Ajzen (1975). TRA was an original theory in the sense that the researchers hypothesized that a person's behavior intention (BI) was influenced by "a person's attitude (A) and subjective norm (SN). TRA research found that many human behaviours were context-driven. Though designed as an adapted version of TRA, TAM more specifically focused on information systems (IS). TAM explicitly highlights a user's intentions by emphasizing a "person's attitude towards the IS and his or her perceptions concerning its usefulness" (Szajna, 1996) or a person's perceived level of usefulness and perceived ease of use to be more precise.

Davis, Bagozzi and Warshaw (1989) published a study comparing the effectiveness of predicting computer usage by employing both the TRA model and the TAM model. As stated previously, TRA is a more generalized theory of human behaviour whereas TAM "is an adaptation of TRA specifically tailored for modelling user acceptance of information systems" (Davis et al). This study's objective is not to prove or disprove either theory, but rather to identify common factors and underlying determinants of behavioural intentions.

Due to technology acceptance being such a prevalent issue in the world of IS, the researchers suggested that Davis' model continue to be extended upon, modified and subjected to further test and retest methods. This led to Venkatesh and Davis (2000) proposing TAM2, which theorizes "users' mental assessment of the match between important goals at work and the consequences of performing job tasks using the system for forming perceptions regarding the usefulness of the system" (Venkatesh & Davis, 2000). TAM2 seems to perform well both in a voluntary and mandatory environment according to the results. Finally,

Venkatesh and Bala (2008) put together both TAM2 of Venkatesh and Davis (2000) and the determinants model of perceived ease of use of Venkatesh (2000) and developed a new "integrated model of technology acceptance" known as TAM3. The current researchers have reinforced this TAM3 by using the four different types inculcating the "individual differences, system characteristics, social influence and facilitating conditions" which are the determinants of "perceived usefulness" and "perceived ease of use". The newly adopted TAM3 research model moderated the said determinants by experiences and linked the "perceived ease of use" to "perceived usefulness", "computer anxiety" to "perceived ease of use", and "perceived ease of use" to "behavioural intention". Progressively, the results of TAM3 research model were tested in practical settings of IT applications.

Thus, TAM has become a useful instrument of explaining the utilization patterns of various information systems and technologies. Keep this in view and considering the growing popularity of Blockchain technology, we considered it worthwhile to analyse this new technology from a TAM viewpoint. This is an imperative particularly because no study, to our knowledge, has tested the Blockchain technology adoption from a TAM perspective. So, this project is based on a modified version of the afore-mentioned TAM2 in order to identify the factors so that developers can take them into account during system development. There are several indicators of Blockchain technology acceptance that has been discussed in the literature. For this research, the independent constructs are Trust, environmental consciousness, information and rewards. The dependent constructs are perceived usefulness, perceived ease of use, behaviour intention and user satisfaction in using the technology.

This paper focuses mainly on the willingness of the public to use Blockchain technologyin monitoring air pollution, which also reflects the pollution monitoring system transparency. Micheal, (2011) define transparency as "a strategic or mimetic accountability and is required for maintaining trust in the relations with the environment".

2.2 Air Pollution Issues

The existing systems for monitoring air pollution cannot provide a guarantee on the integrity of the information nor the transparency of information required to ensure air quality. Also, an early cloud-computing facility as a substitute solution was proposed by Kassahun et al. (2014), who suggested that the "accessibility and controllability" related with cloud- computing may assist in simplifying the procedure of sharing and tracing information. While, the mention of BCT was not definite, the method described by Kassahun et al. (2014) resembles the BCT features: autonomous and distributed, with comprehensive and reliable information delivery.

The Government of Malaysia has introduced the guiding principle on the monitoring of airborne contaminants for synthetic substances dangerous to wellbeing (Department of Occupational Safety and Health (DOSH), 2002). The Malaysian law requires industries to maintain emission limits (PM2.5 not regulated), maintain Stack Gas Emission Standards, enforces projects offered by industries to use feasible Techniques, requires enterprises to conduct emission records (UNEP, 2015). However, from the perception and contextual investigation is ended, it is seen that the monitoring procedure has not been given need, and because of inadequate hardware, the toxic gases are not estimated (Leman et al., 2009a). The monitoring system in place has significant flaws. First, the existing air displaying instruments are not efficient due to their vast size, more weight, extraordinary cost, and stationariness. Second, possibly many faults in the data sharing structure. Third, human intervention and continuous information manipulation have remained a consistent issue (Yi et al., 2015).

Finally, todays' society has become highly sophisticated and knowledgeable about the environmental issues present. In this comprehensive world, where people have grown highly environment conscious, a global air pollution monitoring is crucial.

2.3 Origin and Potential of BCT

BCT mainly deals with "transparency and traceability challenges". The immutability property is an emergent property of a BCT (Daniel, 2017). It's an open source, public, distributed and peer-to-peer exchange of information, verifiable and immutable in assembly (Nakamoto, 2008). Yet, its "security and trustworthiness" are established by a decentralized, cloud-based and independent protocol. Moreover, BCT is "easily accessible, transparent and highly distributed" (Daniel, 2017). The Blockchain has a low-cost effect when run in accordance with "a public key algorithm" which is "a hash encryption technique and a distributed processing structure and is therefore possible to replace the current centralized ledger structure with a distributed ledger" (Soonduck, 2017). It ensures a distributed and secured platform, which is also "independent and accessible to any connected actor" (Volker, 2017). In providing solutions to the above problems, BCT can be used as a platform to monitor air pollution. The introduction of a BCT air pollution monitoring system will promote transparency, availability and immutability of air pollution information to the people

of Malaysia.

2.4 Application of BCT as a Transparency System (TS)

Regardless of the obvious necessity of clarity and sharing of information in Air pollution monitoring system, existent studies have displayed no mention of BCT regarding this situation. Blockchain has risen as an open and distributed ledger that is able to register transactions amongst participating groups competently as well as in a veritable and lasting way. This is supported by an arrangement of peer-to-peer networks, consensus-making, cryptography, and business mechanisms (Diedrich, 2016). In the initial stages of BCT, it is gradually being implemented as TS for customer merchandises, and ensures data integrity and transparency (Risius et al., 2017).

For the sake of simplicity, this research suggests a groundbreaking structural design through combining a power efficient protocol and a communal Blockchain. This research aims to resolve the issue of single point of failure (centralization) through Blockchain-based resolution which automatically incorporates the information retrieved from IoT devices into the Blockchain (BC). Blockchain offers ways to store back-linked blocks of data in an autonomous and distributed manner. Due to applications based on Blockchain technology, an authentic, decentralized, trustworthy data ledger has been made possible for the very first time. Moreover, the information stored in Blockchain system is available to the public, hence, solving the transparency and availability issues.

3. Research Model and Hypotheses

As the current literature proves inadequate to provide a conceptual model of TAM in Blockchain, empirical based research is needed for explaining the detailed determinants of technology acceptance and their impact on behavioural intention of users of air pollution Blockchain. This study has emphasized the need for technology acceptance dimensions to include security and information and accordingly formulate a research model for comprehending the perceptions of users regarding BCT acceptance. According to the model, technology acceptance dimensions are connected with the two performance measures, one of "perceived usefulness" and the other of "perceived ease of use", and in turn linked to "behaviour intentions" (see Figure 1).

3.1 Technology acceptance dimensions

This research utilized the revised TAM scale items to create dimensions of Blockchain technology acceptance through security, environment consciousness, information and rewards. The relationship among the TAM dimensions and behaviour intention ishypothesized and discussed below.

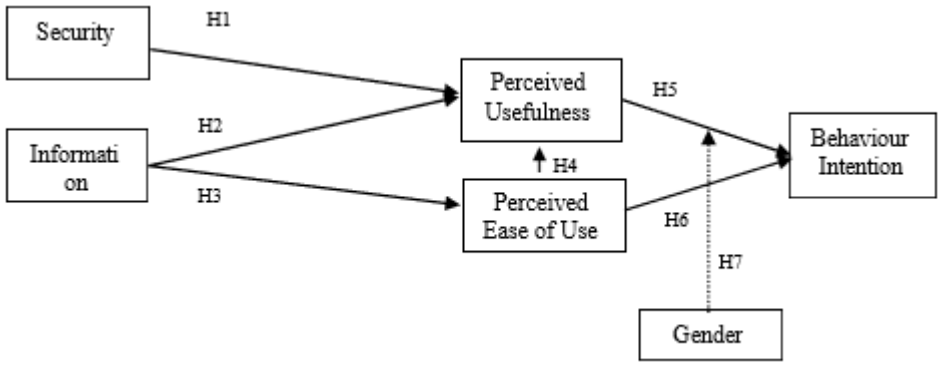

Fig. 1 Research Framework

3.1.1 Security.

Security refers to "the risk associated with online transactions and privacy of sensitive personal information and is closely linked with the trustfulness of online companies" (Zhilin et al., 2014). Previous research suggests that having security features would help achieve consumers' trust and that adding other technical features such as "recommendation agents and personalization schemes can help to create a favorable attitude in consumers toward their websites" (Anil, 2016). Prior research also indicates that since "perception of security is high and the commercial relationship is long", but people still "tend to provide more personal and financial information with less concern" when they have confidence (Juan et al., 2009). Moreover, security has proven to be the strongest parameter affecting future consumption behaviour (Noel et al., 2018). Also, Shareef et al. (2011) defined Information Security as the process of identifying issues that have the possibility to cause damage

or threat situations and implementing protections to eliminate this potential. Finally, on one side, today's "distributed platform-networked environments" are here to stay for the estimated future, and on the other, the issue of security will become gradually "more critical for business viability and recoverability" (Kevin, 1995). Hence, the current study proposes the following hypothesis:

H1. Security positively and significantly influences Perceived usefulness amongst users.

3.1.2 Information.

Information is an "elusive concept" and there is "a continuing debate about its meaning and about its relationship to its correlates such as knowledge, expertise, the learning process and cognitive psychology" (David, 1995). A firm's ability to deliver quality service depends on "its capacity to collect, process and distribute information" (Blair et al., 1995). Christopher (2001) defines information management as "a collection and dissemination of information to the benefit of an organization and its related individuals". For maximizing the extent to which the context attached to transferred knowledge is comprehended, "information quality, such as how detailed, easy-to-read, or descriptive the information is more important for internet users than information quantity" (Jihye et al., 2005). Incomprehensible information is neither reliable nor relevant to users. Prior studiesalso suggest that managers "should pay attention to improve the quality of information, which can indirectly enhance the usefulness of knowledge transfer and convey information more clearly and effectively" and thus in turn can also help its users' perceived usefulness (Ren- Zong et al., 2009). Further, studies on the role of information in market creation have found that "whilst supply and demand is already there in the market, the information available and the degree of freedom for customers to decide on their actions heavily impact vital parameters of the market" (Petr et al., 2012). Hence, the following two hypotheses are proposed:

H2. Information positively and significantly influences Perceived usefulness amongst users.

H3. Information positively and significantly influences Perceived ease of use amongst users.

3.1.3 Gender Moderation and Knowledge Moderation.

Gender issues and related discussions were not a common topic of discussion and research until the end of the 20th century (Gilligan, 1982). Around mid-1990s, the mentioned issues started to be studied further. Researches have been carried out on gender strategies concerning processing of information (Darley and Smith, 1995), procedure of major males' and females' decision (Dube and Morgan, 1996), presenting gifts (Meyers-Levy, 1988) and taking decisions (Mitchell and Walsh, 2004). Research explains gender role as a regulating variable of customer reaction to advertising schemes (Meyers-Levy and Sternthal, 1991). Specifically, in consumer research, noteworthy dissimilarities were discovered in male and female behaviours (Herter et al., 2014; Ma et al., 2014).

Many investigations of customer behavior proposed that both genders fluctuate in their handling of information (Holbrook, 1986; Palmer and Bejou, 1995); notably, both genders react distinctively to opt for overwhelming events undertakings and stimuli (e.g., Words vs. pictures) (Meyers-Levy, 1989). Mainly non-verbal improvements are responded by females also by inspiring progressively cooperative, imagery-laced understandings, and further intricate reports than males (Gilligan, 1982). This phenomenon indicates that essential differences in males and females may add to the role of moderating for dispositions and online goals. Likewise, making decisions on relevant information from online are more delicate with females than males when taking decisions (Evanschitzky and Wunderlich, 2006; Melnyk et al., 2009).

As genders stick to elective sex roles, for personalities with stronger feminine or manly personalities settle on various utilization decisions in like manner (San Martín & Jiménez, 2011). It has been outlined that males are conducted overwhelmingly also by adjusting inclinations and stress self-declaration, self-viability, authority, and evasion of anxiety and vulnerability (Laroche et al., 2000). This wonder suggests that the impact of individual familiarity with safety on dispositions and online buying targets might be moderated by both males and females, and such an effect is estimated to be robust for male buyers than for females.

Gender specifically is a factor that impacts web utilization (Jackson et al., 2008; Zhang, 2005). Because of gender, the exact proof of their behavior is conflicting (Costa, 1994; Fischer and Arnold, 1994). Hence, we need to accept that contemplating the moderating impact of gender could be appreciated on that it is a standout amongst the most regularly utilized factors because of its openness and effortlessness. Also, gender is the supreme significant variable relating to online behavioral attitudes (San Martín & Jiménez, 2011). Indeed some studies have analyzed the importance of gender in the online context, but the need is there for the empirical evidence regarding the moderating role of gender on the relationship between the intention to use interactive technology and to purchase. Therefore, this paper proposes the following hypothesis based on gender:

H7 The relationship between Perceived usefulness and

Behavior intention is stronger formales than for females.

3.1.4 Perceived Usefulness (PU) and Perceived ease of use (PEOU).

Perceived Usefulness (PU) and Perceived Ease of Use (PEOU) represent advantageous results derived from attributes of the technology being used. PEOU represents the degree to which any technologyis free of effort in terms of usage (Rupak et al., 2014). TAM suggests that PU and PEOU are substantial factors impacting the approval of an information system (Davis et al., 1989). Davis has defined PU as "the degree to which a person believes that using a particular system would enhance his or her job performance" (1989). In case of TAM, PEOU is a major factor that affects acceptance of information system (Davis et al., 1989). It is defined as "the degree to which a person believes that using a particular system would be free of effort" (Davis, 1989). Further, perceived ease of use was found to be an important predictor of perceived usefulness at all time periods (Venkatesh & Bala, 2008). Given that the users observe a positive association with a system that has been newly introduced, it will help them in task performance which will later result in them mounting an assertive behavior towards the system. The expectation is that PU and PEOU are suitable as "cognitive constructs" and are core principles that effect behaviour intention (BI). According to Davis(1989) explanation, users will certainly accept systems if they are proven to be user-friendly. The empirical discoveries in the study direct that the two most significant theories that impact behavioral intention were PEOU and PU (Jose and Ana, 2011).

Therefore, such applications have more prospective and users will naturally acknowledge a solution that appears to be further user friendly than other solutions. Thus, the following hypotheses are proposed:

H4. Perceived ease of use significantly affects and positively influences the Perceived usefulness.

H5. Perceived usefulness significantly affects and positively influences the Behaviorintention.

H6. Perceived ease of use significantly affects and positively influences the Behavior intention.

4. Research Methodology

4.1 Measures

Table I lists the construct definitions of the instruments used along with the related literature. This study adapted the measures used to operationalize the constructs included in the investigated model from relevant previous studies. Items for measuring security and information were revised from Janda et al. (2002), items for PU were revised from TAM model suggested by Davis (1989) and items for PEU and behavioural intention were revised by TAM model suggested by Venkatesh and Bala (2008).

All items were measured using a "five-point Likert-type scale" (ranging from 1 = strongly disagree to 5 = strongly agree). With the establishment of content validity, the questionnaire was refined through rigorous pretesting. The pretesting focused on "instrument clarity, question wording and validity". During the pretesting, 20 experienced users were taken as subjects and invited to comment on the questions and wordings. The comments of these 20 individuals provided a basis for revisions to the construct measures. Based on these, several items were discarded from the instrument.

4.2 Subjects and procedure

In the first stage, participants were given a brief on Blockchain air pollution. The mechanism of this system was explained in detail to the respondants. In the second satge, a total of 100 questionnaires were distributed to students across all courses in Malaysia in the year 2019. The selection of the student as respondants in this study is due to three reasons. First, according to a recent study, it is seen that 91.11 percent students make use of Internet for various purposes (Fayaz, 2011), of whom college or undergraduate students are the biggest group of individual internet users. Second, online customers generally are younger and more educated than conventional customers, meaning that "the student subjects closely resemble the online population" (McKnight et al., 2002). Finally, a recent study shows that millennials are consistently more environment sensitive and believe that they can do things in their daily lives that would positively impact the environment (The Millennium development goal report, 2014).

Construct	Definition	References
Security	Users' perception of security refers to the risk associated with online transactions and privacy of sensitive personal information and is closely linked with the trustfulness of online companies	Zhilin et al. (2014)
Information	Users' perception of `information management" is the degree to which the distribution of information benefits an organization and its related individuals	Christopher (2006)
Perceived ease of use	The degree to which a user believes that using Blockchain Technology can be free of effort	Davis et al. (1989)
Perceived Usefulness	The degree to which a user believes that using a particular system would enhance his or her job performance	Davis et al. (1989)
Behavioral Intention	Users' intention to adopt the Blockchain technology for Air pollution monitoring	Venkatesh et al. (2003)

Table I: Constructs definition

The study was conducted in the following stages. First, the subjects were given a briefing on the characteristics of Blockchain technology and on various implication related to the usage of this particular technology for air pollution monitoring. Next, to prove the usefulness of the research model, a quantitative questionnaire method was used to collect data from 100 selected graduates from Malaysia. Confirmatory factor analysis (CFA) was conducted to examine the reliability and validity of the measurement model, and the structural equation modelling (SEM) technique was used to test the research model. The response rate was 100 percent. The test results provided a valuable reference for researchers interested in the latest technology adoptions.

5. Data analysis and Results (Direct Model)

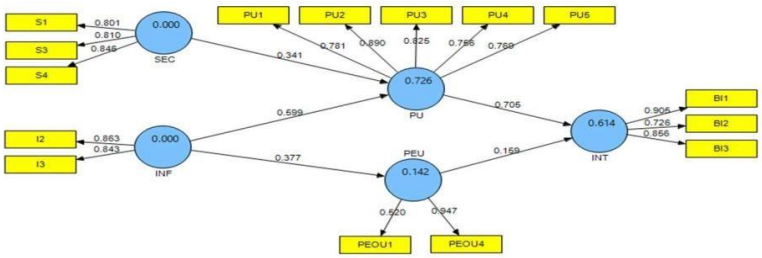

Fig. 2: Direct Model 1

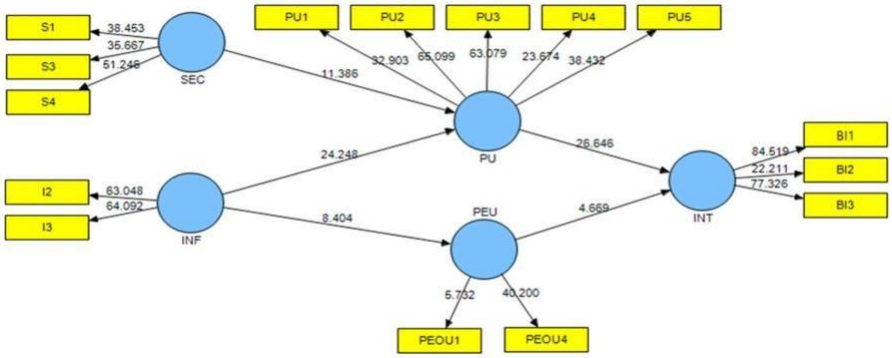

Fig. 3: Direct Model 2

Figure 2 and Figure 3 depicts the model for this study. The good fit of the model is presented with acceptable R^2 values and has good construct reliability (Gefen et al., 2000). The R^2 value of this model represents the predictive capability of the model (Chin, 1998; Komiak and Benbasat, 2004). Table 2 provides the data for the corresponding reliability, composite reliability, and average variance extracted (AVE) assessments. The Composite Reliability (CR) assumes that all indicators are not weighted equally (Chin, 1998), thus attesting to the fact that composite reliability is a more acceptable assessment to evaluate the model's reliability. The cut-off value for the composite reliability is suggested to be above 0.7 (Barclay et al., 1995; Fornell and Larcker, 1981).

On the other hand, the AVE values represent the amount of variance of a construct in ratio to the measurement error (Chin, 1998). The proposed model is a first-order factor model. Therefore, the minimum critical AVE value is 0.5 (Hu et al., 2004). The composite reliability and AVE values in Table 2 meet these requirements.

	AVE	AVEsqrt	CR	R Square	CA
INF	0.728	0.853	0.842	0.000	0.626
INT	0.693	0.833	0.870	0.614	0.775
PEU	0.583	0.764	0.721	0.142	0.356
PU	0.649	0.806	0.902	0.727	0.864
SEC	0.671	0.819	0.860	0.000	0.756

Table 2: Constructs Validity & Reliability

Convergent validity assessment refers to the items in the questionnaire to load simultaneously as a sole construct. This assessment can be assessed by studying the resulting loading for each set of indicators representing a particular dimension. The values for the standardized loading are suggested to exceed 0.7. This means that the respective indicator has more variance with their respective latent variable compared with its error variance. Chin (1998) has a lesser stringent cut off value at 0.5. All the path coefficients in this model are statistically significant. Discriminant validity assessment refers to how each item loads on its construct compared to other constructs (Kerlinger, 1973; Swafford et al., 2006). This value is accessed via cross-loadings and the correlated value among first-order constructs and the square roots of AVE (Chin, 1998; Fornell and Larcker, 1981). These values are shown in Table 3.

Table 3: Variable Correlation Matrix against AVR Square Root

	INF	INT	PEU	PU	SEC
INF	**0.853**				
INT	0.730	**0.833**			
PEU	0.377	0.449	**0.764**		
PU	0.809	0.770	0.411	**0.806**	
SEC	0.614	0.638	0.364	0.709	**0.819**

Values for the cross-loadings are shown in Table 4. The values show adequate levels of discriminant validity. The bold values in Table 4 show higher loading values to its respective construct and low loading values to other constructs. A similar conclusion is observed in the link between the AVE square root values and the correlations among the first-order latent constructs. Data from Table 3 clearly shows that the square root of AVE (bold numbers in diagonal) are more than the correlations among the constructs (off-diagonal values).

Table 4: Cross-Loading

	INT	INF	PEU	PU	SEC
BI1	**0.905**	0.679	0.307	0.727	0.593
BI2	**0.726**	0.426	0.436	0.504	0.392
BI3	**0.856**	0.690	0.401	0.672	0.587
I2	0.483	**0.863**	0.248	0.750	0.507
I3	0.772	**0.843**	0.400	0.626	0.541
PEOU1	0.201	0.105	**0.520**	0.165	0.047
PEOU4	0.437	0.391	**0.947**	0.408	0.398
PU1	0.653	0.574	0.402	**0.781**	0.511
PU2	0.643	0.698	0.406	**0.890**	0.602
PU3	0.557	0.792	0.276	**0.825**	0.583
PU4	0.587	0.573	0.304	**0.756**	0.542
PU5	0.662	0.606	0.270	**0.769**	0.611
S1	0.598	0.540	0.345	0.597	**0.801**
S3	0.406	0.397	0.201	0.509	**0.810**
S4	0.548	0.555	0.333	0.625	**0.846**

5.1 Moderating Model

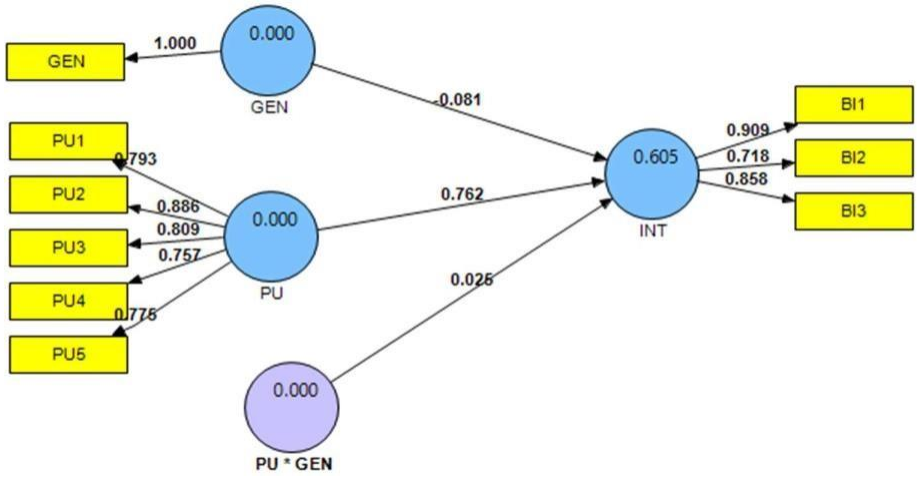

Fig. 4: Moderating Model 1.1

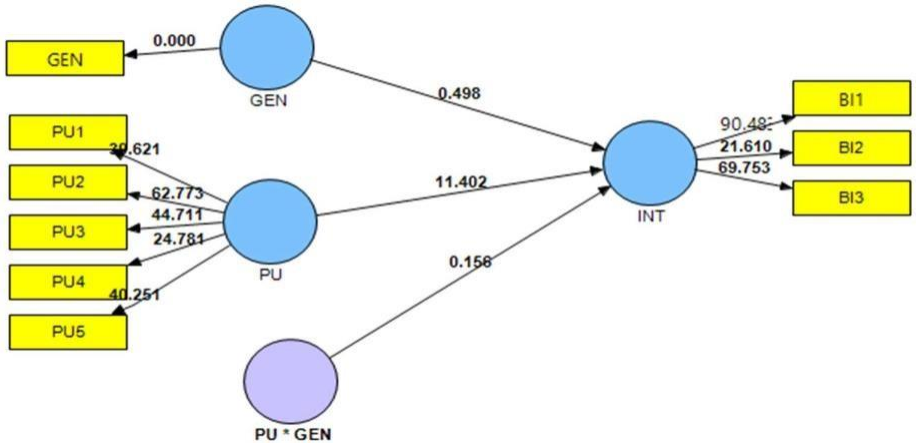

Fig. 5: Moderating Model 1.2

5.2 Moderating effect of Perceived usefullness -GENDER- Intention

From the moderating model 1.2, it shows that gender has a positive moderating effect of the relationship between PU and INT with a path coefficient of 0.025 and it is significant with T-value of 0.156 (one tail). From the result, it can be concluded that gender positively and significantly moderates the relationship between Perceived usefullness and intention for this study.

6. Discussion

This research developed instrument dimensions of BCT acceptance by altering the TAM model in the air pollution monitoring system setting. This study recommended that technology acceptance dimensions incorporate security and information and in addition, built up an exploration model for understanding the opinions of users concerning BC technology acceptance. The model suggested that secutiry and information are linked to Perceived usefulness and Perceived ease of use, and thus Behaviour intention. The analytical outcomes of this investigation are discussed below.

First, the analytical results showed that security most strongly affected perceived usefulness and in turn behaviour intention of users. This analytical result is consistent with that of Juanet al (2009), who found that security is a key determinant of behavioural intention. The results are also consistent with that of Anil (2016), who found that having security features would help gain the confidence of consumers and can help to create a favourable attitude in consumers toward their websites. New technology models thus improve security measures and in the best interests of

customers during the transaction processes.

Second, the information dimension is a significant predictor of perceived usefulness and perceived ease of use, and in turn behaviour intentions of users. Results are consistent with that of other studies, which also found information to be an effective determinant of perceived usefulness and in turn behaviour intention (Ren-Zong et al., 2009). Therefore, to enhance user satisfaction and perceived behaviour intentions, air pollution monitoring systems should start improving the dimensions of information, by providing up-to-date and accurate information, maintain transparency and strengthening the security of online transactions.

Third, this study evaluated the factors underlying intention to adopt Blockchain technology. The results indicated that PU and PEOU affect adoption intention. This study found that PEOU had a greater effect than PU on adoption intention, which may be attributed to the fact that all respondents were young students who are tech savvy and open to new technologies.In terms of user attitudes, most users find the use of Blockchain technology for air pollution monitoring significant and enjoyable to use. A positive attitude towards use leads to a favourable behaviour intention. These results are consistent with the results of Davis et al., (1989) which found that PU and PEOU are significant factors affecting acceptance of an information system. Results are also consistent with other studies which found that PEOU was found to be a significant predictor of PU at all time periods (Venkatesh and Bala, 2008). The empirical findings of Jose and Ana (2011) that found PEOU and PU were the most important constructs that influence behaviour intention was also consistent with our results

Additionally, this study found a positive relationship among overall behaviour intention, perceived usefulness and perceived ease of use.

7. Conclusion

The conclusions drawn from this study make contributions in two main areas. First, this study developed the instrument dimensions of Blockchain technology acceptance through modifying the TAM model in the air pollution monitoring system context. Second, this study identified e-technology acceptance dimensions that affect overall perceived usefulness and perceived ease of use, which in turn are significantly related to behaviour intentions of users. The implications for practitioners and researchers and the limitations of this study are discussed below.

7.1 Limitations and Future Research

This study suffers three main limitations. First, the sample used student participants, which may not be representative of the general population of Blockchain technology users. The analytical results presented here thus may have limited generalizability. Second, since this study only considered users from Malaysia, it is unclear whether the analytical results can be generalized to the rest of the world. Additionally, since the sample was collected in Malaysia, generalizability to other countries might be limited due to cultural differences in behaviour intention. Further research can apply the research model to examine other types of monitoring systems, because online perceptions of new technology adoptions are context-dependent and thus their detailed effects on behaviour intentions may be related to specific technological areas. Finally, this study did not incorporate actual usage behaviour into the proposed research model. However, this shortcoming does not represent a serious limitation since substantial empirical support exists for the causal link between intention and behaviour (Venkatesh and Davis, 2000).

Several future research directions exist. First, future research can use different methodologies, such as longitudinal studies, focus groups and interviews to examine the relationship between technology acceptance and user behaviour intention in air pollution monitoring contexts. Second, the growth of the Blockchain technology and pollution monitoring systems will continue, and future research can replicate similar studies solely involving Blockchain technology adoption, measuring actual usage behaviours instead of intentions. This procedure is designed to understand if there are any significant difference in the perceptions of Blockchain technology adoption for air pollution monitoring and user intentions. Third, although the scales used for measuring dimensions of technology adoption are similar to existing scales, further research might consider developing more elaborate measures to allow for richer coverage of TAM scales. Thus, the study can be replicated in different cultures to provide cross-cultural comparisons.