Behavioural intention to adopt cloud computing: a quantitative analysis with a mediatory factor using bootstrapping

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Article Info

ABSTRACT

This article discusses the research conducted to determine the factors contributing to behavioural intentions (BI) to adopt cloud computing. Small and medium enterprises (SMEs) in the Sri Lanka information technology (IT) sector were surveyed using a questionnaire. The diffusion of innovation (DOI) by Roger and the unified theory of acceptance and use of technology 2 (UTAUT2) by Venkatesh, Thong, and Xu was used as the theoretical framework for evaluating the reference model. Two hundred fifty-six important IT executives from Sri Lanka companies participated in the study. Quantitative techniques of data coding and analysis were applied in this investigation. Statistical package for social sciences (SPSS) software is used for exploratory factor analysis, and analysis of moment structures (AMOS) software is used for confirmatory factor analysis, including bootstrapping for mediator analysis of BI. The results show that among seven hypothesised factors, three factors: relative advantage (RA), compatibility (CT), and complexity (CX), significantly influence BI to adopt cloud computing.

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1. INTRODUCTION

The adoption of cloud computing (ACC) is the latest phenomenon to be more productive in each industry. As cloud computing has already become popular across the globe and different people from different sectors use cloud computing for different reasons [1]. Traditional on-premises computing is shifting to the cloud, which benefits both businesses and individuals [2].

Sri Lanka is one of the fastest developing countries in Asia. Information technology (IT) is a rapidly growing industry among the other industries in Sri Lanka. The workforce of IT doubled over five years, and it has grown by 120% over the past five years, making it one of the highest growth areas in the economy [3]. Currently, almost all the small and medium enterprises (SMEs) in Sri Lanka use at least one cloud service, knowingly or unknowingly using the software as a service (SaaS). During the COVID-19 pandemic, all the traditional (office-based) work switched to working from home, and SMEs utilised it without any downtime to continue their business. The IT companies encourage employees to work from home by tunnelling staff through virtual private networks (VPN) or collaborative platforms. COVID-19 enables Sri Lanka SMEs employees with a new culture of work by working in the comfort of their homes by utilising cloud-based software. Technology acceptance is one of the major aspects that every individual or organisation is willing to adopt cloud computing in their business. Researchers have been trying to pinpoint what characteristics lead to the

widespread acceptance of new technologies for decades. Several ideas and models have been developed to examine how people take in and use new technology.

Behavioral intention has been identified as a crucial factor for cloud computing adoption, as evidenced by studies [4]–[9]. The current research specifically focuses on the behavioral intentions of IT industry SMEs in Sri Lanka regarding the ACC. This study aims to gain insights into the factors that influence SMEs' intentions to embrace cloud computing in Sri Lanka.

The process of adopting to new technology is the subject of a number of theories and models. The diffusion of innovations (DOI) [10], the technology-organization-environment (TOE) framework [11], the theory of reasoned action (TRA) [12], the technology acceptance model (TAM) [13], the technology acceptance model 2 (TAM2) [14], the technology acceptance model 3 (TAM3) [15], unified theory of acceptance and use of technology (UTAUT) [16] and unified theory of acceptance and use of technology 2 (UTAUT2) [17] are most prominent theoretical frameworks in this field. DOI and UTAUT2 are the most extensively used theories that seek to explain and predict cloud computing adoption. The majority of these theories explain and forecast the adoption choice based on technological factors.

Observability, relative advantage (RA), compatibility (CT), complexity (CX), and trialability comprise DOI theory's five main components [10]. RA, CT, and CX are chosen as the study's independent variables from among these criteria. The following elements are included in the UTAUT2 theory: price value (PV), habit, awareness, behavioural intention (BI), and use behavior. performance expectancy (PE), effort expectancy (EE), social influence, facilitating conditions, and hedonic motivation (HM) [17]. Among these factors, PE, EE, HM, and PV are selected as independent factors of this study. Many studies have shown that serves as a strong mediator [4]–[8], [14]–[17] that mediate the dependent factor, ACC with all independent factors.

2. LITERATURE REVIEW

To establish a theoretical foundation for evaluating the reference model, the study extensively examined two prominent technological adoption models: DOI and UTAUT2. By thoroughly reviewing these models, the study aimed to gain a comprehensive understanding of the factors influencing technology adoption and usage, enabling a comprehensive assessment of the reference model's efficacy and relevance. The in-depth analysis of DOI and UTAUT2 served as essential pillars for constructing a robust theoretical framework for evaluating the reference model.

2.1. Diffusion of innovation

Roger's original DOI theory [10] is been used since 1962, yet it's still widely used to explain how new technologies emerge. The theory specifies the elements contributing to the spread of novel innovations or practices throughout a society [10]. Roger outlined the five main components of invention: "RA, CT, CX, trialability, and observability" [10]. Among these five factors, RA, CX, and CT are the most impactful on adopting different innovations [18].

2.1.1. Relative advantage

Rogers *et al.* [10] defines RA as "the degree to which an innovation is perceived as being better than the idea it supersedes." According to Lee [19], the RA of adopting new information systems (IS) innovation is seen as a key indicator. The larger an organisation's perceived benefit from an innovation, the higher the possibility it could adopt it. RA has a significant relationship with the intention towards ACC [20]–[24].

2.1.2. Complexity

Rogers *et al.* [10] stated that CX is "the degree to which an innovation is perceived as relatively difficult to understand and use". According to Sahin [25], CX refers to the difficulty of understanding and using innovations. To increase adoption, new technologies must be user-friendly and simple to use, whereas adoption is less likely if innovations are more complicated to use. CX is linked negatively to decision-making on adoption. CX has a significant relationship with the intention toward ACC [21]–[23], [26], [27].

2.1.3. Compatibility

Rogers *et al.* [10] states that "the degree to which an innovation is perceived to be consistent with current values, experiences, and needs of potential adopters is called CT". Innovations that are in line with human norms and principles or social framework expectations are more likely to be accepted in a society. According to Lertwongsatien and Wongpinunwatana [28], CT refers to technological and operational requirements which must be compatible with the adopting organisation's principles and technological needs. The perceived high CT of innovation with current technology in the organisation may positively impact the adoption process [11]. CT has a significant relationship with the intention toward ACC [20]–[24], [26].

2.2. Unified theory of acceptance and use of technology 2

The theory is proposed by Venkatesh *et al.* [17]; it is the second iteration of UTAUT proposed by Venkatesh *et al.* [16] by incorporating several new elements that play a role in determining the level of acceptance of the technology. UTAUT2 includes the following factors; "performance expectancy, EE, social influence, facilitating conditions, HM, PV, habit, awareness, BI, and use behavior" [17]. From these factors, PE, EE, HM, PV, and BI are adopted to form the conceptual model of this study.

2.2.1. Performance expectancy

The PE refers to the degree to which an individual perceives that using a system will help them improve job performance. It is a strong BI predictor in which an individual assumes that the system can help to make job performance enhancements [16]. PE has a significant relationship with the intention to adopt cloud computing [4]–[8], [29].

2.2.2. Effort expectancy

The EE refers to the level of ease of use associated with the use of IT. It is a BI predictor which measures the level of easiness related to the use of the information system [16]. EE has a significant relationship with the intention to adopt cloud computing [4]–[8], [29].

2.2.3. Hedonic motivation

The enjoyment or pleasure extracted from technology is known as HM. It is significant when assessing technological acceptance and predicts BI to use technology [17]. HM has a significant relationship with the intention to adopt cloud computing [4]–[6], [8].

2.2.4. Price value

The PV is described as the emotional relationship of users between the advantages provided by applications and the monetary costs associated with their use. The cost and price system can greatly impact the use of technology by users. The PV is favourable since it has been demonstrated that the technology's advantages are more than the expense. The PV positively affects BI to use and is determined as a predictor of BI [17]. PV has a significant relationship with the intention to the ACC [4], [6]–[8], [21], [26], [30].

2.3. Behavioural intention

BI is "a person's subjective probability that he will perform some behaviour" [12]. Schiffman and Kanuk *et al.* [31] stated that "adoption or usage intention is the psychological decision-making process where a user has a need, he or she would be induced to satisfy the need by searching relative information according to his and her own experience and external environment, then evaluating and considering all information, and deciding to use a product after comparison and judgment of another alternative". BI has a significant relationship with the ACC [4]–[8].

The independent and dependent variables have been explored in the previous studies as the factors in technology adoption theories to enhance knowledge of how emerging technologies have been implemented. There are different variations in the viewpoint of DOI and UTAUT2 adoption theories described. All possible factors affecting the BI to adopt new technology have been described as integrated into a single comprehensive model. Certain variables in each study are not equivalent in all studies. Some variables are important in the study and have been chosen, while others are not appropriate.

3.   METHOD

This study focuses on the BI of small and medium-sized IT companies in Sri Lanka to adopt cloud computing. The conceptual framework illustrated in Figure 1 by evaluating with two technology adoption theories: Rogers *et al.* [10] DOI and Venkatesh *et al.* [17] UTAUT2. For this study, a review of the literature and tests done with SMEs in Sri Lanka's IT industry showed that seven independent variables can be used to make a conceptual model for cloud adoption. These variables include RA, CT, CX, PE, EE, HM, and PV. In addition, a BI variable that acts as a mediator and ACC that acts as a dependent variable was found.

In addition, based on the literature, seven hypothetical relationships are constructed, as depicted in Table 1. In order to verify the validity of the hypothesis, responses from 256 different IT companies in Sri Lanka were gathered and analysed in the survey. The most senior officials from each organisation provided their input for the data collection. In this study, quantitative research approaches were employed to collect data in the form of a pre-structured questionnaire. The information gathered is then entered into version 27 of the SPSS software, where it is coded and analysed. The dependability of the information gathered is then tested

with cron batches alpha. AMOS software version 28 is employed to generate results to obtain the model fit of the conceptual model.
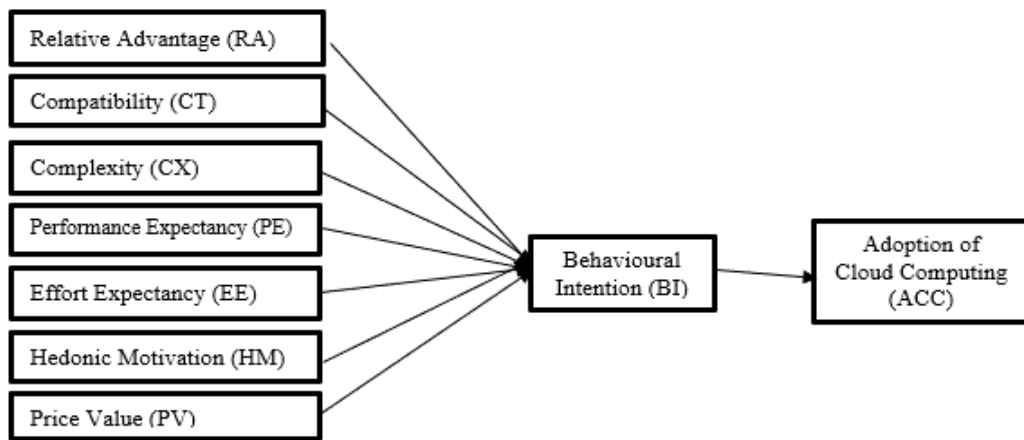

Figure 1. Conceptual framework

Table 1. Research hypothesis

Hypothesis	Relationship
H1	Behavioural intention mediates relative advantage towards the adoption of cloud computing
H2	Behavioural intention mediates compatibility toward the adoption of cloud computing
H3	Behavioural intention mediates complexity towards the adoption of cloud computing
H4	Behavioural intention mediates performance expectancy towards the adoption of cloud computing
H5	Behavioural intention mediates effort expectancy towards the adoption of cloud computing
H6	Behavioural intention mediates hedonic motivation toward the adoption of cloud computing
H7	Behavioural intention mediates price value towards the adoption of cloud computing

4. RESULTS AND DISCUSSION
4.1. Descriptive analysis

The descriptive analysis carried out and the descriptive summary obtained on each factor including mean and standard deviation with correlation matrix. We confirm that all variables' average and standard deviation are within acceptable ranges. According to the correlation estimations, all latent variables were positively connected to one another.

The exploratory factor analysis carried out on all the factors as the results shown in Table 2, the Kaiser-Meyer-Olkin (KMO) value for all the factors above 0.80 (>=0.60: [32], [33]), which is considered as excellent. A single factor that explained on each factor is well above the threshold value (>60%: [32]) of the total variation was extracted. The smallest factor loading on all the factors are more than 0.7 (>0.5: [32]), and the smallest communality value in all the factors are more than 0.5 (>0.3: [33]) is also considered excellent.

The factors must be valid and reliable to be considered internally consistent and measured using an acceptable scale. Validity is measured by the KMO value; if the value is more than or equal to 0.60 considered acceptable, more than 0.70 is considered good, and over 0.80 is considered excellent [32], [33]. Cronbach's alpha measures the reliability; if the cronbach's alpha is near 1 considered higher reliability of internal consistency. Although the alpha less than 0.60 is considered poor, more than 0.70 is considered acceptable, and over 0.80 is considered good [34]. The validity and reliability summary of the all factors are valid and reliable.

Table 2. Summary of exploratory factor analysis with validity and reliability

Factors	KMO	TVE	Smaller factor loading	Smaller commu-nality	Cronbach's alpha	No. of items	Reliability
Relative advantage (RA)	0.883	71.757%	0.827	0.684	0.900	5	Higher reliability
Compatibility (CT)	0.864	71.985%	0.788	0.621	0.901	5	Higher reliability
Complexity (CX)	0.898	75.858%	0.851	0.724	0.920	5	Higher reliability
Performance expectancy (PE)	0.909	82.564%	0.897	0.805	0.947	5	Higher reliability
Effort expectancy (EE)	0.892	74.567%	0.824	0.679	0.914	5	Higher reliability
Hedonic motivation (HM)	0.873	77.385%	0.838	0.703	0.927	5	Higher reliability
Price value (PV)	0.841	63.284%	0.745	0.555	0.852	5	Good reliability
Behavioural intention (BI)	0.899	75.177%	0.843	0.710	0.917	4	Higher reliability
Adoption of cloud computing (ACC)	0.940	78.395%	0.843	0.710	0.954	7	Higher reliability
Overall	0.960	70.943%			0.973	46	Higher reliability

4.2. Structural equation modelling

SEM is an approach that was used to investigate the correlations between the variables in the research model. SEM is a multivariate technique "combining aspects of factor analysis and multiple regression that enables the researcher to simultaneously examine a series of interrelated dependence relationships among the measured variables and latent constructs (variates) as well as between several latent constructs" [30].

A two-phase procedure was used to analyse SEM data in this research. The first phase was utilising CFA to verify the items that measure the variable and evaluate the measurement model's fitness. The second phase was to create a structural model by establishing dependency connections between the study model's hypothesised variables. In this second phase of SEM, the hypotheses were tested. AMOS software was used for the SEM analysis.

4.3. Measurement model fit with confirmatory factor analysis

CFA is a multivariate method that can be used to test the validity of a measurement theory. Using CFA, it can be verified that the indicator values accurately match those of the latent variable. The main objective of the CFA is to check if the data fits a certain model structure. The factors and relationships between the variables in CFA are first identified based on a theory [32]. The model's parameters are estimated using the maximum-likelihood technique based on variance-covariance matrices [32]. In order to evaluate the model's fit, there are a number of fit indices that can be used. According to Awang [35], there are mainly three model fit categories in CFA: absolute fit, incremental fit and parsimonious fit and they are indicated respectively; RMSEA=0.049 (<0.08: [36]), CFI=0.945 (CFI >0.90: [37]) and normed chi-square=1.601 (<5.0: [38]) are acceptable. As per the measurement model, all the items with a factor loading of more than 0.5 are considered acceptable [32]. It has been confirmed that the data fit well with our model by meeting the recommended threshold values for fit indices. The measurement model for the study was constructed with all the items, as shown in Figure 2.

4.4. Structural model evaluation

According to Awang [35], the structural model is "the model that demonstrates the inter-relationships among constructs in the study. The constructs are assembled into the structural model based on the hypothesis stated in the theoretical framework". A structural model is considered a measurement model with constraints. In the measurement model, structural paths replace the correlations between the constructs. These paths show how important the relationships between the constructs are. Also, only hypothesised direct links are drawn between exogenous variables, with the exception of correlational links (covariances). These are the main differences between measurement models and structural models [32]. Figure 3 shows the structural model with model fit indices. The model fit indices absolute fit, incremental fit and parsimonious fit indicated respectively; RMSEA=0.049 (<0.08: [36]), CFI=0.945 (CFI>0.90: [37]) and normed chi-square=1.601 (<5.0: [38]) are acceptable. It has been confirmed that the data fit well with our model by meeting the recommended threshold values for fit indices. However, it should be taken into consideration that the incremental fit measured via CFI value is fairly lower than the required level in this situation. In contrast, the absolute and parsimonious fit values are well in the accepted level.

Nonetheless, this model should be accepted and authorised because goodness-of-fit indices only provide statistical significance [32], [39]–[41]. Besides this statistical significance, there are also methodological and theoretical justifications in the social science studies those ought to be remembered before declining a model. Thus, it ought to not just depend on statistical significance. Regarding this issue, Byrne [41] detailed out the consideration and justification: "Global fit indices alone cannot possibly envelop all that needs

to be known about a model to judge the adequacy of its fit to the sample data. Exclusive reliance on goodness-of-fit indices is unacceptable. Indeed, fit indices provide no guarantee whatsoever that a model is useful. In fact, a model can fit well and yet still be incorrectly specified. Fit indices yield information bearing only on the model's lack of fit. More importantly, they can in no way reflect the extent to which the model is plausible; this judgment rests squarely on the shoulders of the researcher. Thus, assessment of model adequacy must be based on multiple criteria that take into account: theoretical, statistical, and practical considerations". All in all, it is noted that the structural model demonstrated the best-fit indices as shown in Figure 3.
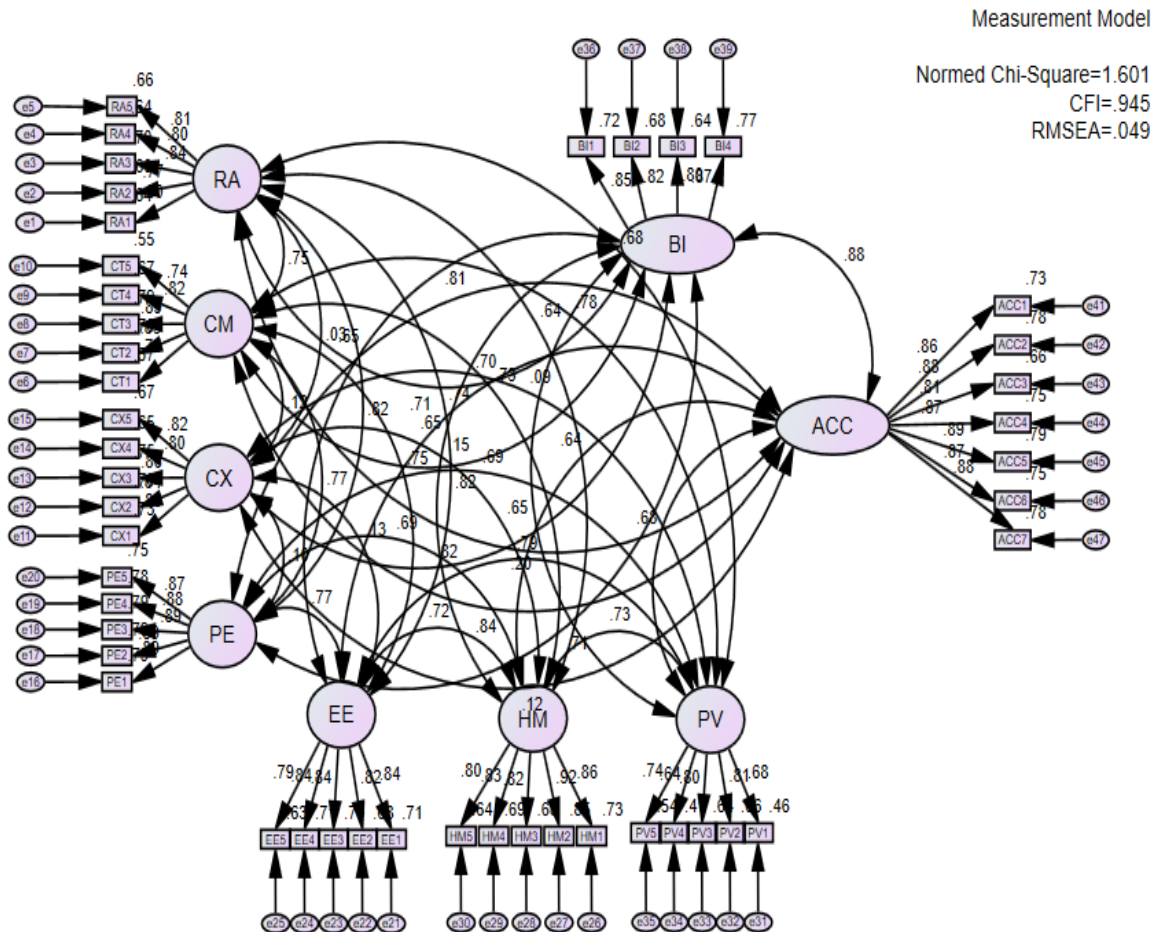
Figure 2. Measurement model

4.5. Mediating relationships

According to Flurry et al. [32], Sekaran and Roger [34], the mediating variable emerges between the moment that the independent variables begin to influence the dependent variable and the time that their effect is felt on the dependent variable. The mediating effect is the "effect of a third variable/construct intervening between two other related constructs" [30]. The study consists of mediating factor BI that mediates between seven independent factors: RA, CT, CX, PE, EE, HM, and PV towards the dependent factor ACC.

Flurry et al. [32] described that the mediation is represented by the indirect effect formed from two causal paths explained as full mediation and partial mediation. The "full mediation is a sequence relationship proposing that an independent variable causes an intermediate variable, which in turn causes an outcome variable (X→M→Y). Partial mediation is an effect when a direct relationship between a predictor and an outcome is reduced but remains significant when a mediator is also entered as an additional predictor" [30].

Testing the mediation effect mainly two methods: sobel test and bootstrapping. Asadi et al. [30] stated that the Sobel test is "a parametric statistical test for the significance of the indirect effect in mediation. Criticised for low power, researchers have suggested using bootstrapping as an alternative test of significance". Further [42], explained that using AMOS with bootstrapping is one of the best methods and can be achieved with a few steps. The structural model is performed with 2,000 bootstrapping samples. The results of

standardised direct effects and standardised indirect effects are measured with a bootstrap estimate and two-tailed significance values depicted in Table 3.

The bootstrapping test on mediation effect found that there is a partial mediating relationships of factor BI is available between the factor RA and ACC, factor CT and ACC; the full mediating relationship of BI is available between CX and ACC. Further, it is found that there is no mediation relationship of BI is available between the factors PE, EE, HM, and PV with ACC.
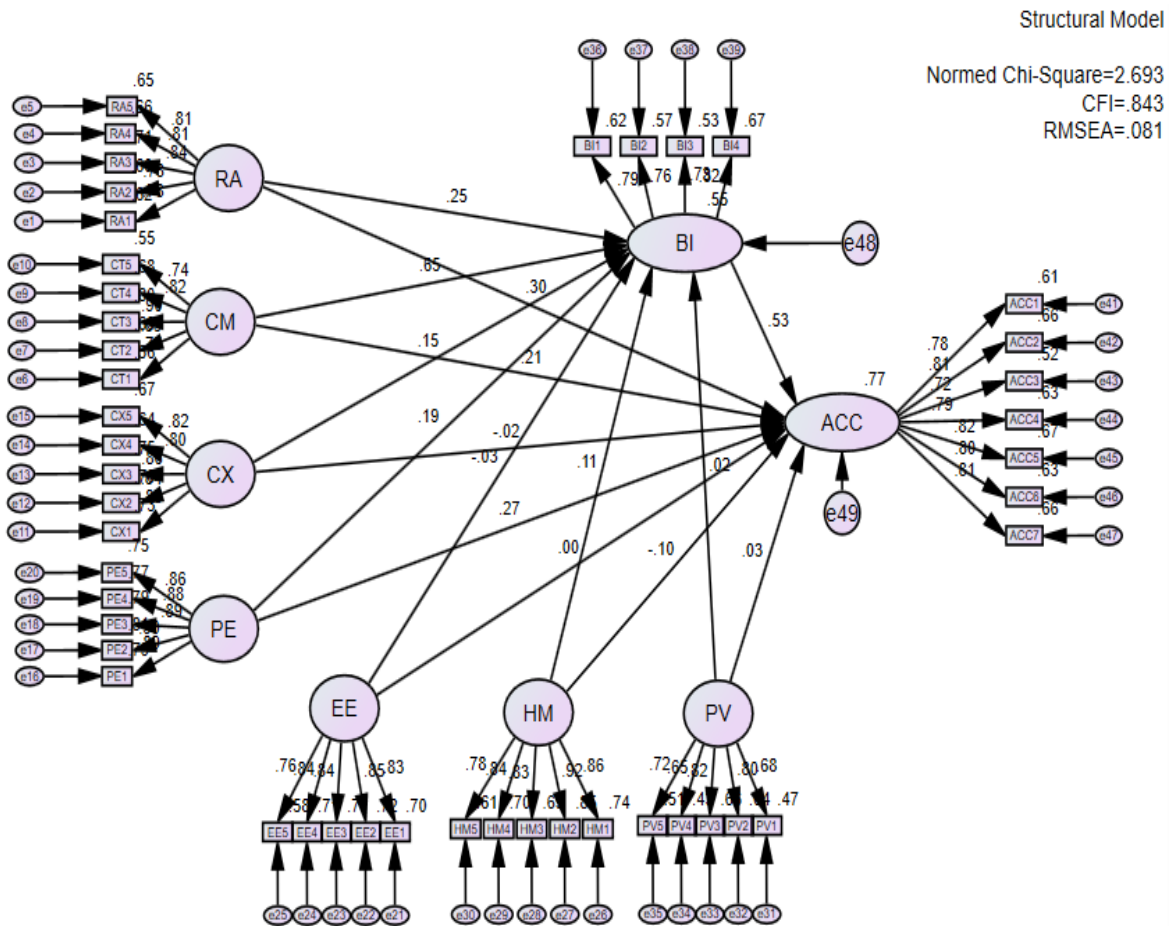
Figure 3. Structural equation model

Table 3. Mediating relationships

Relationship	Direct effect	Indirect effect	Result
RA→BI→ACC	0.304*	0.131*	Partial mediation
CM→BI→ACC	0.214*	0.344*	Partial mediation
CX→BI→ACC	-0.19(NS)	0.078*	Full mediation
PE→BI→ACC	0.270*	0.100(NS)	No mediation
EE→BI→ACC	0.003 (NS)	-0.016(NS)	No mediation
HM→BI→ACC	-0.100 (NS)	0.058(NS)	No mediation
PV→BI→ACC	0.032 (NS)	0.008(NS)	No mediation

*=p<0.05; NS-not significant

4.6. Hypothesis testing

This section addresses the hypotheses put forward in Table 1 in light of the SEM results. The final model of the study, depicted in Figure 3 as the structural equation model, was used to test these hypotheses. Since the study only focus on the BI on the adoption of cloud computing, the mediation relationship only required to be analyses as shown in the Table 3. The regression weight results of the final structural model are shown in Table 4, which is used to measure the p-value (<0.05: [32], [34]) of each relationship; the relationship

between the factors is RA and ACC, CM and ACC, and CX and ACC are significant. The relationship between the factors PE and ACC, EE and ACC, HM and ACC, and PV and ACC are not significant. The standardised regression weights result of the final structural model are also shown in Table 4 measures the estimated value or strength of each relationship. As per the analysis and results, it is concluded that the hypothesis H1-H3 were supported: H1 and H2 supported with partial mediation and H3 is supported with full mediation. Further hypothesis H4-H7 were not supported.

Table 4. Hypothesis testing using p-value and standardised estimates

Hypothesis	Relationship	P-value	Estimate	Decision
H1	RA→BI→ACC	0.003	0.131	Supported with partial mediation
H2	CM→BI→ACC	0.000	0.344	Supported with partial mediation
H3	CX→BI→ACC	0.010	0.078	Supported with full mediation
H4	PE→BI→ACC	0.122	0.100	Not supported
H5	EE→BI→ACC	0.744	-0.016	Not supported
H6	HM→BI→ACC	0.135	0.058	Not supported
H7	PV→BI→ACC	0.783	0.008	Not supported

5.   CONCLUSION

The adoption of cloud computing is increasing in Sri Lanka due to its significant benefits. The research focused on the BI to adopt cloud computing in SMEs in Sri Lanka, especially in IT industry. As highlighted, SMEs in Sri Lanka are hesitant to use cloud computing for various reasons. The study discovered that three of the seven independent factors that were tested contributed to the intention to adopt cloud computing: RA, complexity, and CT. The independent factors performance expectation, EE, HM, and PV had no effect on the intention to use cloud computing.

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