



Received: 17 June, 2022

Accepted: 21 July, 2022

Published: 22 July, 2022

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**Keywords:** Theory of reasoned action; Theory of planned behavior; Integrated behavioral model; Factor analysis; Diagonally weighted least squares estimation; Polychoric correlations; Precursor variables; Theoretical sufficiency

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## Research Article

# Evaluating the Effectiveness of Reasoned-action Theories (TRA, TPB, IBM) for Explaining Low E-commerce Adoption in a Developing Country: A Structural Equation Modelling (SEM) approach AI trends in digital humanities research

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## Abstract

This paper explains the process of e-commerce adoption through reasoned action theories (theory of reasoned action (TRA), theory of planned behavior (TPB), and integrated behavioral model (IBM)) in a developing country. Owing to a lack of precedent in the study settings, the study first validated empirical scales for measuring psychosocial drivers of behavior using exploratory and confirmatory factor analyses. Subsequently, the study validated the aforementioned models using structural equation modeling, and also integrated sociodemographic characteristics as precursor variables in the model with the greatest predictive power. Results depicted that while TRA and TPB explain behavior well, it is IBM that is the most effective in explaining online consumer behavior, and underlined the importance of using volitional, sociodemographic, and individual-level factors (knowledge of e-commerce and environmental constraints to use e-commerce) to explain online consumer behavior. The study has numerous implications for e-commerce vendors operating in developing countries as the validated scales and models can be used to assess individual perceptions regarding e-commerce and to design effective communication strategies, respectively.

## Introduction

Online shopping or Business-to-consumer (B2C) e-commerce is the process through which consumers avail services or purchase products using the internet [1]. In most developed and developing countries, businesses have adopted e-commerce to reach consumers because of its widely touted benefits [2]. Adoption of e-commerce is a complex phenomenon because usage of the internet for shopping is predicated on the acceptance and use of IT in everyday life. In some developing countries like Pakistan, consumers have lagged severely in adopting e-commerce despite a large portion of the population

having internet access. Despite a large number of businesses investing in their online platforms, there currently exists little to no research which has attempted to explain the slow adoption of e-commerce among consumers. The purpose of this study is to employ constructs put forward by reasoned action theories to understand online consumer behavior.

Adoption of e-commerce is dependent upon the transference of perceived benefits of e-commerce from businesses to consumers; these perceived benefits affect consumers' cognitive attitude towards e-commerce. Secondly, the "spatial and temporal separation" between consumers and

online businesses, the ease with which personal information is collected on online platforms, and concerns about the uncertainty of the online environment reduce consumers' perceived control over their behavior [3]. Furthermore, in a closely-knit community such as Pakistan, individuals' behaviors are heavily influenced by the perceived normative environment. Hence, these constructs, attitudes, perceived norms, and perceived behavioral control as described in reasoned action theories (theory of reasoned action (TRA), theory of planned behavior (TPB), and integrated behavioral model (IBM)) are critical in explaining the adoption of e-commerce and understanding online consumer behavior.

Reasoned action theories serve as the classical models of persuasion in psychology and health behaviour [4], and have been successful in predicting behavior across multiple disciplines including the adoption of e-commerce. This study will compare the explanatory power of TRA, TPB, and IBM for the adoption of e-commerce. However, there currently exist no validated empirical scales for these constructs in the study's context, and these constructs and models have not been previously validated for Pakistan. Hence, the secondary aim of this study is to develop and validate empirical scales for behavioral predictors of e-commerce adoption, establish measurement validity of these constructs, and subsequently validate these models for e-commerce adoption in Pakistan.

### Online consumer behavior in Pakistan

Pakistan is the world's second-slowest adopter of internet shopping patterns over the web [5]. There are over 29 million internet users in Pakistan (14 percent of the total population), and the average internet penetration rate is 29.14 percent [5]. 70 percent of people actively involved in e-commerce activities are between the ages of 18 and 34, and 70 percent of e-commerce users were men [5]. However, the conversion rate which included only those who in reality buy online was almost the same for both genders. The conversion rate for new visitors ranged from 1.20 percent to 2.60 percent and returning visitors ranged from 2.60 to 3 percent [5]. Online networking does not play a dynamic part in impacting online buyers in Pakistan. Moreover, a large portion of the general population has negative involvement in web shopping [6]. In the last few years, the subject of e-commerce in Pakistan has been gaining traction, but to the best of the author's knowledge, there have not been any studies yet which have identified specific predictors of online shopping behavior.

### Evolution of reasoned action theories

**Theory of reasoned action:** Among the three classic models of persuasion in psychology and health behavior, the Theory of Reasoned Action (TRA) was the first to be developed [7]. TRA (Figure 1) proposed that behavioral intention is the most proximal predictor of behavior, and attitude towards performing the behavior and subjective norms associated with the behavior are the direct determinants of behavioral intention [8]. TRA distinguished itself from its antecedents by differentiating between different types of attitudes and introducing subjective norms as a distal predictor of behavior.

Attitude towards performing the behavior was formed by an individual's cognitive beliefs about the behavior and individual's evaluation of the behavioral outcome [9]. This can be illustrated by an example of a man's attitude towards an airplane and his attitude towards flying. Likewise, the subjective norm was formed by the individual's perception of approval or disapproval from close referents to engage in the behavior, and the individual's motivation to comply with close referents [8].

### Theory of planned behavior

TPB (Figure 2) is an extension of TRA; TPB accounted for volitional factors outside of the individual's control that affects behavioral intention and behavior [10]. The new construct, perceived behavioral control, was determined by control beliefs regarding barriers and facilitators in the individual's environment, and the perceived power of these barriers and facilitators to aid or obstruct behavior [8]. Perceived control underlines the individual's ability to perform the behavior, and this ability along with intention served as proximal predictors of behavior in TPB. More specifically, in situations where volitional control over the behavior is high, intention serves as the sole proximal predictor of behavior, but in situations with low volitional control over the behavior, perceived control is expected to serve as a proximal predictor of behavior along with intention [11]. In TPB, perceived control becomes the third direct determinant of intention along with attitude and subjective norms. The ability of these theoretical constructs to predict behavioral intention varies with different behaviors and different populations [8]. Furthermore, TPB also delineates the specification of external variables (sociodemographic variables, knowledge of the behavior, personality traits, environmental characteristics, and other individual-level variables) into the framework. The framework postulates that the impact of external variables on behavioral intention and behavior is completely mediated by the model constructs. Since its proposition, the theory has become one of the most widely-used frameworks for predicting various behaviors [12]. Moreover, studies in the past have used TPB to identify salient beliefs that determine consumers' behavioral intention and adoption of e-commerce [1,2,13-15].

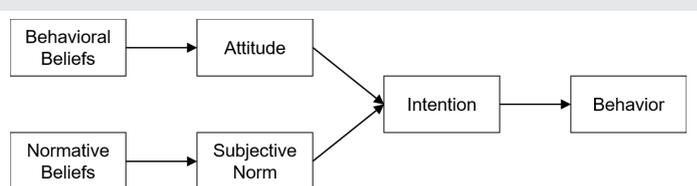


Figure 1: The Theory of Reasoned Action [7].

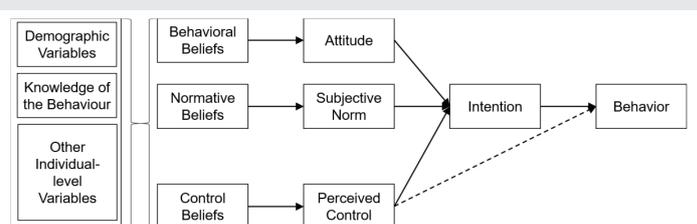


Figure 2: The Theory of Planned Behavior [10].

## Integrated behavioral model

Psychosocial drivers of behavioral intention and behavior were integrated into an Integrated Behavioral Model (IBM) (Figure 3) [16]. Four components (knowledge and skills to perform the behavior, salience of the behavior, environmental constraints, and habit) moderating the relationship between behavioral intention and behavior were added to the model, and these components directly determined behavior [17]. Translation of behavioral intention into behavioral performance is predicated on the presence of three of these four components [8]. Firstly, an individual with high intention to perform a certain behavior cannot do so unless he or she possesses the knowledge and skills to perform the behavior. Secondly, there should be minimal or no environmental constraints in the individual's environment that make the performance of the behavior difficult. Thirdly, the behavior should be salient to the individual. The fourth component which isn't mandatory is the experience the individual yields from performing the behavior, and a positive experience may turn the behavioral performance into a habit and render behavioral intention less critical in the process [18]. Like TRA/TPB, the behavioral intention had three proximal determinants, attitude towards the behavior, perceived norms associated with the behavior, and personal agency towards the behavior [19]. Attitude's antecedents were experiential (affective) attitude and instrumental (cognitive) attitude, perceived norms' antecedents were injunctive (close referents) norms and descriptive (social network) norms, and personal agency's antecedents were perceived control (barriers and facilitators) and self-efficacy (confidence to perform the behavior). Studies recommend using IBM as it incorporates constructs from TRA/TPB and constructs from other influential behavioral theories [8].

## Behavior and behavioral intention

In this study's context, behavior is self-reported and refers to the adoption of e-commerce for shopping. A meta-analysis of 185 independent studies reported that TPB accounted for 27 percent and 39 percent of the variance in behavior and behavioral intention, and further reported that behavioral intention was the strongest predictor of behavior with an average correlation of .47 between the two constructs; moreover, intention solely explained 22 percent of the variation in behavior [20]. Various behavioral theories have posited behavioral intention as the strongest predictor of behavior including the three reasoned action theories. Behavioral intention is defined as the individual's motivation or willingness to perform a certain behavior [11]. Based on the theoretical support and empirical evidence, this study suggests that

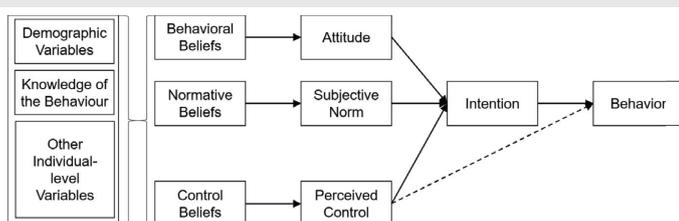


Figure 3: Integrated Behavioral Model [19].

## H1 Behavioral intention to adopt e-commerce positively influences the adoption of e-commerce for shopping

### Psychosocial drivers of behavior and behavioral intention

**Attitude:** Behavioral scientists have for long posited that attitude is a proximal determinant of intention, and does not directly predict behavior [10].

## H2 Attitude towards adoption of e-commerce strongly predicts behavioral intention to adopt e-commerce for shopping

In this study's context, attitude towards the behavior is defined as the consumers' evaluation of the idea of adopting e-commerce for shopping.

**Perceived Norm:** Perceived norm associated with the behavior reflects an individual's willingness to act as referents act or the social pressure individual feels to act (Pavlou & Fygenson, 2006). Based on the theoretical support, this study suggests

## H3 Perceived norm associated with the adoption of e-commerce increases an individual's intention to adopt e-commerce for shopping

In this study's context, the perceived norm associated with the behavior is defined as the social pressure individual feels to adopt e-commerce for shopping. This study is the first to use reasoned action theories to understand online consumer behavior in Pakistan. Past studies have argued that the constructs behave differently in Asian settings owing to the differences in the socio-cultural and normative environment between Western and Asian societies [21-24]. Specifically, the relationship between normative beliefs and attitudinal beliefs, and normative beliefs and control beliefs. TPB/TRA posits that attitudinal, normative, and control beliefs are independent of each other, but multiple studies in the past have provided empirical evidence that favorably perceived norm leads to a favorable attitude towards the behavior [21,22,25,26]. If an individual's close referents consider the behavior to be important, it would lead to the individual developing a positive attitude towards the behavior. Hence, this study suggests.

## H3a Perceived norm associated with the adoption of e-commerce positively influences attitudes towards the adoption of e-commerce for shopping

In the study's context, if one believes that one's close referents expect him or her to adopt e-commerce then it would improve one's evaluation of the idea of adopting e-commerce for shopping. Furthermore, in Eastern cultures, it has also been argued that favorably perceived norm associated with the behavior increases an individual's agency to perform the behavior [27]. If the individual's close referents consider the behavior to be important then it would improve the individual's perception of barriers and facilitators in the environment, and it would subsequently increase the individual's confidence to perform the behavior. Therefore, this study suggests.

### H3b Perceived norm associated with the adoption of e-commerce positively affects personal agency towards the adoption of e-commerce for shopping

In the study's context, if one believes that one's close referents expect him or her to adopt e-commerce then it would improve one's agency to adopt e-commerce for shopping.

**Personal Agency:** Personal agency towards the behavior is one's degree of confidence in the ability to perform the behavior and perception of one's ability to navigate barriers in the environment [28]. As mentioned earlier, personal agency becomes a stronger direct determinant of behavior along with intention in low volitional control situations. A meta-analysis of TPB/TRA reported that perceived control is an adequate predictor of intention ( $r = .43$ ) and behavior ( $r = .37$ ), and solely explained 13 percent of the variance in behavior [20]. Therefore, this study suggests.

### H4 Personal agency towards adoption of e-commerce increases adoption of e-commerce for shopping

### H5 Personal agency towards adoption of e-commerce increases intention to adopt e-commerce for shopping

In the context of this study, if an individual feels confident in adopting e-commerce and believes that he or she can navigate barriers in the environment then it would increase his intention to adopt and directly influence the adoption of e-commerce for shopping.

## Methods

### Eliciting psychosocial drivers of behavior

The three psychosocial drivers of behavior (attitude, perceived norms, and personal agency) behave differently in different populations for different behaviors and lack generalizability. Therefore, for each behavior, salient beliefs need to be identified for the behavior which is specific to the study's context [10]. To identify salient beliefs, 30 participants aged 18-34 were interviewed using an open-ended questionnaire. Experiential attitudinal beliefs could not be elicited as e-commerce was perceived as a utility by the participants, and they did not associate an emotional response with the outcome. Beliefs that had a frequency of 20 percent or greater were chosen [10]. Attitudinal beliefs were 1) perceived usefulness, 2) perceived efficiency, and 3) varieties offered. Normative beliefs included the beliefs of parents and spouses regarding the utility of e-commerce for the respondents. Agency beliefs included 1) perceived ease of use, 2) skills and 3) decision-making authority. The study was further able to elicit individuals' beliefs regarding knowledge and skills to perform the behavior and environmental constraints. Participants believed that knowledge of online retailers, skills to shop online, and knowledge of modes of transactions constituted fundamental knowledge and skills required to use e-commerce. Furthermore, lack of access to the internet and the absence of mediums that are used for e-commerce transactions were identified as the critical environmental constraints to using e-commerce.

## Control variables

Based on the Integrated Behavioral Model, the study would control behavior for knowledge and skills to perform the behavior and environmental constraints. Past behavior was not included in the study as it does not provide any psychological insight [11]. Moreover, in theory-driven models, adding demographic variables as control variables or direct predictors of behavior violates the *a priori* theory. Hence, they should be included as precursor variables that predict the distal variables in the framework i.e. attitude, norms, and agency [29]. This subsequently tests the assumption of theoretical sufficiency (complete mediation of background variables by psychosocial predictors on target behavior) [29]. If the precursor variables have a direct impact on the target behavior, then the assumption of theoretical sufficiency would be violated. If there is no direct impact of the precursor variables on the target behavior then the assumption of theoretical sufficiency will hold. Precursor variables in this study are age, marital status, personal income, household income, sex, and the highest level of education attained.

## Measurement development

Given that there was no scientific precedence for how these constructs should be measured in the study's context, evidence was gathered from past studies that used similar measures in similar contexts [1,2,14]. Moreover, guidelines presented by Glanz et al. [8] to develop a robust instrument based on IBM/TPB were adopted and contextualized. Items in the study instrument (Supplementary Table S1 for Questionnaire) were formed based on findings from interviews and existing literature [8]. The target behavior was assessed by asking the respondents whether they had used e-commerce for shopping in the last six months which is aligned with defining the behavior within a specified target, action, context, and time frame (TACT) [30]. All psychosocial constructs were measured through a five-point Likert scale (1 = Not at all, 2 = Not really, 3 = Don't know, 4 = Somewhat, 5 = Definitely). Three items were targeted at assessing behavioral intention [8]. Attitude had three direct measures and five indirect measures with each indirect measure having an outcome evaluation item. Perceived norms had three direct measures and three indirect measures with each indirect measure having a motivation to comply item. Personal agency had three direct measures, two indirect measures for perceived control with a score of perceived power for each measure, and three direct measures for self-efficacy. All evaluation items (outcome evaluation, motivation to comply, and perceived power) were assessed using a seven-point Likert scale.

## Survey administration

Once the initial pool of items was finalized, a pre-test was conducted with a small sample size of 50 students. Inter-item reliability and theoretical validity of relationships among variables were checked through the pre-test data. We yielded greater than acceptable Ordinal alphas for most measures, and all associations theorized by the model were demonstrated by the composite variables. The final instrument subsequently had 46 items.



The study's final sample size was 400. The eligibility criteria were being a student in a university in the city of Karachi. The survey was administered through enumerators who distributed the questionnaires at the universities, and students were asked to return the questionnaires to the enumerator upon completion of the questionnaire. Respondents provided informed consent and their anonymity was ensured as the questionnaires did not require any identifiable information.

### Statistical analysis

**Sample size estimation:** To ascertain the adequacy of the sample size for the factor analytic process, the subject-to-variables (STV) ratio was used to ascertain the adequacy of the sample for factor analysis [31]. Generally, an STV greater than 5 is considered acceptable. Hence, with 29 psychometric variables, a sample size of 290 was required to achieve an STV of 10.

### Exploratory factor analysis

Although a theoretical model was specified a priori warranting a Confirmatory Factor Analysis (CFA) to confirm the measurement validity, the model describes constructs that are based on theoretically-sound concepts, but are being tested in a non-Western culture, and are measured through previously un-validated and new items [32]. Exploratory Factor Analysis (EFA) therefore, preceded CFA to examine which constructs emerge and whether they harmonize with the model described [33]. As recommended in the literature on factor analysis, polychoric correlations were obtained to account for the ordinal nature of data [32]. LISREL 9.3's Ordinal Factor Analysis function uses the recommended methodology by default. Kaiser criterion<sup>1</sup> is commonly used to determine the optimal number of factors to retain (Kaiser, 1958) [34]. McDonald's Omega<sup>2</sup> was used to compare multiple factor solutions.

### Structural equation modelling

CFA using Diagonally Weighted Least Squares (DWLS) estimation fitted to polychoric correlations and asymptotic covariances was used to run the measurement and hierarchical models. The goodness of fit statistics (Satorra-Bentler (SB)  $\chi^2$ , Root Mean Square Error of Approximation (RMSEA), Comparative Fit Index (CFI), and Standardized Root Mean Square Residual (SRMR)) were obtained for the models [35]. Model fit was assessed based on the following cut-off values for the goodness of fit statistics ( $\chi^2$  significance, RMSEA  $\leq$  0.05, CFI  $\geq$  .95, SRMR  $\leq$  .08) [35]. Furthermore, the reliability of each indicator<sup>3</sup> was observed to identify items that can be dropped.

### Reliability and validity

Final factors' reliability was assessed through composite reliability<sup>4</sup> (also known as the reliability of the construct), maximal reliability<sup>5</sup> (also known as Coefficient H), and ordinal alpha obtained through polychoric correlations [37-39]. Constructs validity was assessed by predictive validity, convergent validity, and construct validity [40,41]. Predictive validity was evaluated by examining correlations between the

theorized outcome variable (intention to adopt e-commerce) and its predictors (attitude, perceived norms, personal agency, and knowledge) [33]. CFA was conducted to confirm or disconfirm construct validity. Convergent validity assesses the degree to which items that are theorized to be correlated or to be not correlated have high or low correlation among them [41]. Construct validity was established through CFA and Average Variance Extracted (AVE)<sup>6</sup> [37].

### Results

Data were entered in Microsoft Excel 2016, cleaned, and checked for missing values. Missing values were not imputed as the percentage of missing values was lower than 10 percent, and the respective cases were handled using listwise deletion. Data were analyzed using Stata MP v13.1 and LISREL 9.3. The total number of completed questionnaires was 340 (85 percent).

Respondents in the sample had a mean age of 22.4 (SD = 2.49). 68 percent of the respondents were male and 32 percent of the respondents were female. This disproportion was deliberate to account for the disproportion present in e-commerce usage of the population (Table 1 for Sociodemographic Characteristics) (Supplementary Table S1 for Descriptive Statistics of Psychometric Items).

<sup>1</sup>Kaiser Criterion dictates that only factors with eigenvalues greater than 1 should be retained.

<sup>2</sup>McDonald's Omega is used to correct for the downward bias of Alpha, which is the lower-bound of reliability. (C. Guguu, Coryn, & Applegate, 2010) [36] We used Ordinal Omega since loadings were obtained through polychoric correlations. Omega can be calculated by

$$\omega = \frac{(\sum l_j)^2}{(\sum l_j)^2 + \sum u_j^2}$$

Where  $l_j$  is, the factor loading and  $u_j$  is the unique variance of each item  $j$ .

<sup>3</sup>Reliability of indicator is calculated by squaring the standardized factor loading. This assesses the reliability of each individual item, and reliability of indicator below 0.4 was considered inadequate.

<sup>4</sup>Composite Reliability (CR) assesses the degree of reliability with which the latent factor explains the variance in observed variables. CR should be greater than 0.7 for the factor to be acceptable. (Fornell & Larcker, 1981) The formula for calculating Composite Reliability is

$$CR = \frac{(\sum_{i=1}^p l_i)^2}{[(\sum_{i=1}^p l_i)^2 + (\sum_{i=1}^p (1-l_i^2))]}$$

Where  $l$  is the standardized loading of items.

<sup>5</sup>Maximal Reliability assesses reliability for multidimensional composite scores when items within subtests are parallel. (Hancock & Mueller, 2001) Formula for estimating Coefficient H is

$$H = \frac{1}{1 + \frac{1}{\frac{l_1^2}{(1-l_1^2)} + \dots + \frac{l_p^2}{(1-l_p^2)}}}$$

<sup>6</sup>Where  $l_1$  is the first standardized loading and  $l_p$  is the last standardized loading.



### Factor analysis

Using a seed value, the dataset was randomly split into two datasets of sample sizes 140 and 200 for EFA and CFA, respectively. Item descriptive statistics were compared to ensure that data is split datasets were not statistically different. Two-sample unpaired t-test was used to compare differences between the samples, and no statistically significant differences were found. With 29 psychometric variables and a sample size of 140, an STV ratio of 5 was achieved, which is considered low but adequate [33].

### Exploratory factor analysis

EFA using Unweighted Least Squares estimation fitted to polychoric correlations yielded a seven-factor solution as the most optimal solution. Subsequently, eight-factor and six-factor solutions were extracted as well for comparison and were subjected to Oblique Promax rotation as constructs were theorized to be correlated [42]. Factor loadings below .51 were not considered owing to the small sample size [43]. Factors with less than three items of loadings greater than .5 were not considered [33]. Six-factor solution yielded the highest Omega (.81) and had five factors with at least three items of loadings greater than 0.5. The five extracted factors were Intention (five items), Attitude (four items), Perceived Norms (five items), Personal Agency (three items), and Knowledge (four items) (Table 2 for Standardized Factor Loadings of the Rotated Pattern Matrix).

### Confirmatory factor analysis

CFA using Diagonally Weighted Least Squares (DWLS) estimation fitted to polychoric correlations and asymptotic covariances was used to run the measurement model of 19 items on LISREL. With 19 items and 200 cases, an STV of 10.5 was obtained which is adequate for conducting CFA. The five-factor measurement model with 19 items yielded an adequate fit [SB  $\chi^2$  (142, N = 200) = 222.05 ( $p < .001$ ), CFI = .97, SRMR = .07, RMSEA = .05, RMSEA 90 percent Confidence Interval (.03; .06)]. Despite the model fitting well, there were some items that performed poorly. Three items had a reliability of indicator below 0.4 and were dropped from their respective scales. This reduced the total number of items to 16, and the final scales for intention, attitude, perceived norms, personal agency, and knowledge had three, three, four, three, and three items respectively. The final measurement model with 16 items yielded an adequate fit as well [SB  $\chi^2$  (94, N = 200) = 160.78 ( $p < .001$ ), CFI = .97, SRMR = .06, RMSEA = .05, RMSEA 90 percent Confidence Interval (.04; .07)].

### Reliability and validity

Composite reliability for the five factors ranged between .76 and .90, Coefficient H for the five factors ranged between .85 and .94, and ordinal alpha for the five factors ranged between .75 and .89. Based on these statistics, the factors were considered to be reliable.

Significant correlations between intention and predictors were (see Table 3. Factor Correlation Matrix), indicative of

**Table 1:** Sociodemographic characteristics.

Variables	Mean (SD) or Percentage (n)
Age	22.62 (3.26)
Sex	
Male	68.37 (227)
Female	31.63 (105)
The highest level of education attained or ongoing	
Undergraduate	70.52 (232)
Graduate	20.67 (68)
Doctoral	8.81 (29)
Marital Status	
Single	87.61 (290)
Engaged, Married, Divorced, or Widowed	12.39 (41)
Unemployed	63.08 (205)
Household Income per month	
Less than \$450	7.33 (22)
\$450 to \$900	15.33 (46)
\$901 to \$1350	17.00 (51)
\$1350 to \$1800	20.33 (61)
More than \$1800	40.00 (120)

**Table 2:** Standardized Factor Loadings of the Rotated Pattern Matrix (Final Five Factors).

Factor/Latent Construct	Statements	Standardized Factor Loadings
Factor 1 (Intention to Adopt E-commerce)	I expect to adopt e-commerce for shopping.	0.9
	I want to adopt e-commerce for shopping.	0.889
	I intend to adopt e-commerce for shopping.	0.958
	*I think that e-commerce is useful.	0.527
	*I think that using e-commerce is a wise thing to do.	0.512
Factor 2 (Attitude towards E-commerce)	Shopping online will save me time.	0.735
	Shopping online will be more convenient for me.	0.788
	If I shop online, I'd be making less effort to fulfill my needs	0.721
	If I shop online, I'd be able to give more time to my tasks other than shopping.	0.596
Factor 3 (Perceived Norms associated with E-commerce)	People who are important to me think that I should use e-commerce to save time.	0.862
	People who are important to me advise me to use e-commerce to save time.	0.917
	People who are important to me think that using e-commerce is wise.	0.648
	My parents/spouse think that I should use e-commerce for shopping.	0.552
	My close friends think that I should use e-commerce for shopping.	0.645
Factor 4 (Personal Agency towards E-commerce)	It is difficult for me to use e-commerce for shopping.	0.902
	It is my decision whether or not to use e-commerce for shopping.	0.533
	It is easy for me to use e-commerce for shopping.	0.757
Factor 5 (Knowledge of E-commerce)	I know online retailers	0.855
	I know how to shop online	0.786
	I know different modes of transacting online	0.792
	I know of online retailers who deliver in my area	0.579

predictive validity [33]. Items within a scale were highly correlated with each other, and their correlations with items from other scales were relatively lower (See Supplementary Table S2 for Polychoric Correlation Matrix). CFA established construct validity for all factors, and AVE for all factors ranged between .52 and .74.

### Structural equation modelling

EFA and CFA established the presence of five reliable and valid latent factors that can be used to test the structural validity of the paths specified by the reasoned action theories. SEM using DWLS estimation fitted to polychoric correlations and asymptotic covariances was used to run the following models.

### Theory of Reasoned Action (TRA)

As per the paths specified in TRA, we tested the first model (TRA) (Figure 4). The model yielded an adequate fit [SB  $\chi^2$  (41, N = 340) = 96.93 ( $p < .001$ ), CFI = .97, SRMR = .05, RMSEA = .06, RMSEA 90 percent Confidence Interval (.05; .07)], and explained 12 percent and 40 percent of the variance in behavior and intention, respectively.

We tested TRA with an additional path from the subjective norm to attitude to test our *a priori* hypothesis (Figure 5). The model yielded a marginally better fit [SB  $\chi^2$  (41, N = 340) = 83.06 ( $p < .001$ ), CFI = .98, SRMR = .05, RMSEA = .05, RMSEA 90 percent Confidence Interval (.03; .07)]. Subjective norm explained 27 percent of the variance in attitude, however, there was no change in the explanation of variance for intention and behavior.

### Theory of Planned Behavior (TPB)

The third model that we tested was based on TPB specifications hence Personal Agency and Knowledge were introduced into the model (Figure 6). The construct of personal agency was specified as a predictor of both behavior and intention while knowledge was introduced as a predictor of attitude, subjective norm, and personal agency. The model fit was acceptable; however, the CFI fell below the acceptable range [SB  $\chi^2$  (112, N = 340) = 277.18 ( $p < .001$ ), CFI = .93, SRMR = .08, RMSEA = .06, RMSEA 90 percent Confidence Interval (.05; .07)]. The model explained 14 percent of the variance in behavior, 45 percent of the variance in intention, 62 percent of the variance in attitude, 18 percent of the variance in the subjective norm, and 33 percent of the variance in personal

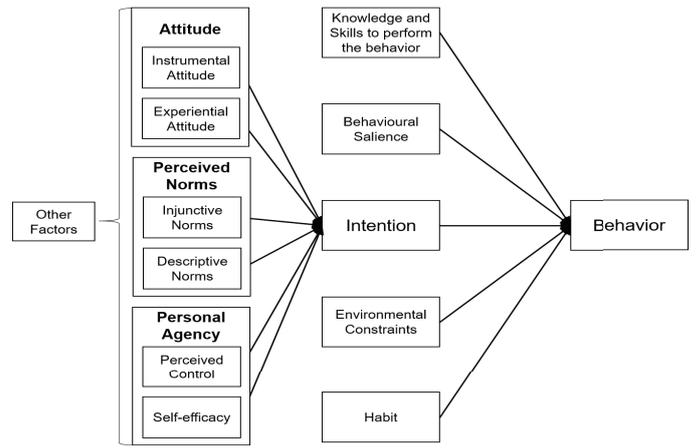


Figure 4: Structural Model 01 (TRA).

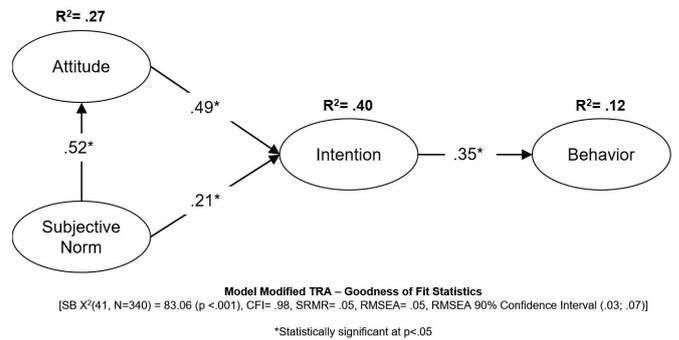


Figure 5: Structural Model 02 (Modified TRA).

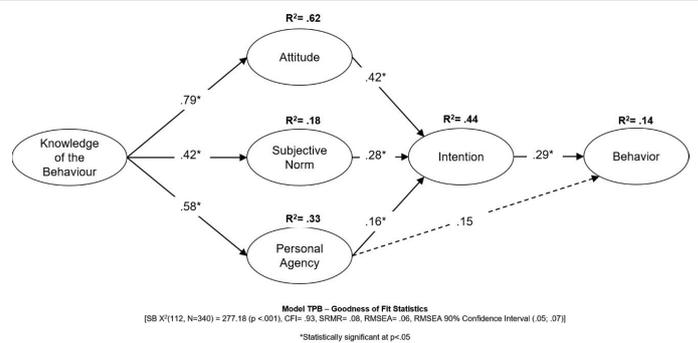


Figure 6: Structural Model 03 (TPB).

agency. The increment in the explanation of the variance of the outcome variables from TRA to TPB is minimal. Moreover, the path from Personal Agency to Behavior is insignificant ( $\beta = .15, p > .05$ ) which aligns with the theory for settings with some or high volitional control. The introduction of Knowledge had a significant impact on all three antecedents of intention, specifically attitude ( $\beta = .79, p < .05$ ) making it a valuable addition to the model.

We further tested TPB with additional paths from the subjective norm to personal agency and attitude and removed the insignificant path from personal agency to behavior (Figure 7). The model yielded an improvement in fit [SB  $\chi^2$  (111, N = 340) = 238.73 ( $p < .001$ ), CFI = .95, SRMR = .06, RMSEA = .05, RMSEA 90 percent Confidence Interval (.04; .06)].

Table 3: Factor Correlation Matrix.

Factors	Intention	Attitude	Perceived Norms	Personal Agency	Knowledge
Intention	1.00				
Attitude	0.65	1.00			
Perceived Norms	0.51	0.56	1.00		
Personal Agency	0.39	0.52	0.20	1.00	
Knowledge	0.36	0.53	0.17	0.49	1.00



Explanatory power of the model improved marginally as well for the key outcome variables. As in Model 2 (Modified TRA), the subjective norm has a substantive impact on attitude ( $\beta = .42, p < .05$ ), and knowledge and subjective norm combine to explain 55 percent of the variance in attitude. However, we did not find a statistically significant impact of subjective norms on personal agency ( $\beta = .08, p > .05$ ).

### Integrated Behavioral Model (IBM)

The fifth model that we tested was based on the path specifications of IBM (Figure 8). The role of Knowledge changed from a predictor of the psychosocial drivers of behavioral intention and behavior to a direct predictor of behavior, and we added Environmental Constraints as another predictor of behavior. The model yielded a good fit [SB  $\chi^2$  (137, N = 340) = 283.38 ( $p < .001$ ), CFI = .95, SRMR = .06, RMSEA = .05, RMSEA 90 percent Confidence Interval (.04; .06)], and explained 22 percent and 44 percent of the variance in behavior and intention, respectively. Knowledge and environmental constraints emerge as statistically significant and substantive predictors ( $\beta = .44, p < .05$ ;  $\beta = -.38, p < .05$ ), along with intention ( $\beta = .32, p < .05$ ), of behavior, and produce the highest  $R^2$  for behavior thus far.

We further tested the two hypothesized paths from the subjective norm to personal agency and attitude (Figure 9). The model was comparatively a poor fit [SB  $\chi^2$  (142, N = 340) = 453.72 ( $p < .001$ ), CFI = .89, SRMR = .12, RMSEA = .08, RMSEA 90 percent Confidence Interval (.07; .09)], and explained less of the outcome variables compared to the previous model. Moreover, the subjective norm's impact on attitude and personal agency was statistically significant ( $\beta = .77, p < .05$ ;  $\beta = .52, p < .05$ ). However, the path from the subjective norm to intention was statistically insignificant ( $\beta = .21, p > .05$ ) which further leads credence to the hypothesis that the impact of the perceived norm is either partially or completely mediated by personal agency and attitude.

Based on the goodness of fit statistics and the  $R^2$  for behavior, we accept IBM (structural model 05) as our final model for subsequent analyses. We will now add sociodemographic characteristics as precursor variables into the model where they will act as determinants of attitude, subjective norm, personal agency, knowledge, and environmental constraints (Figure

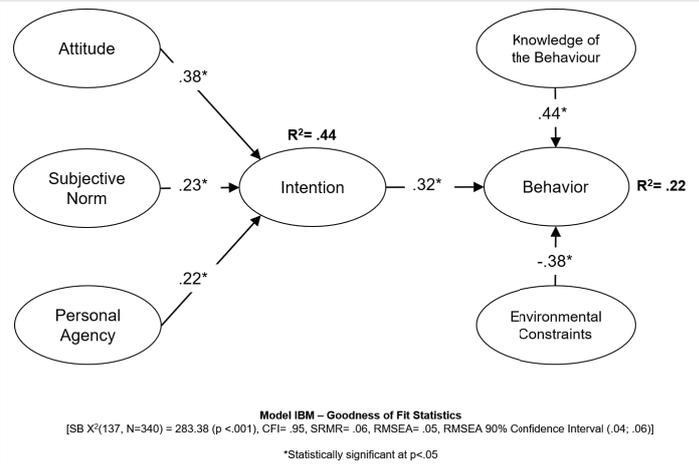


Figure 8: Structural Model 05 (IBM).

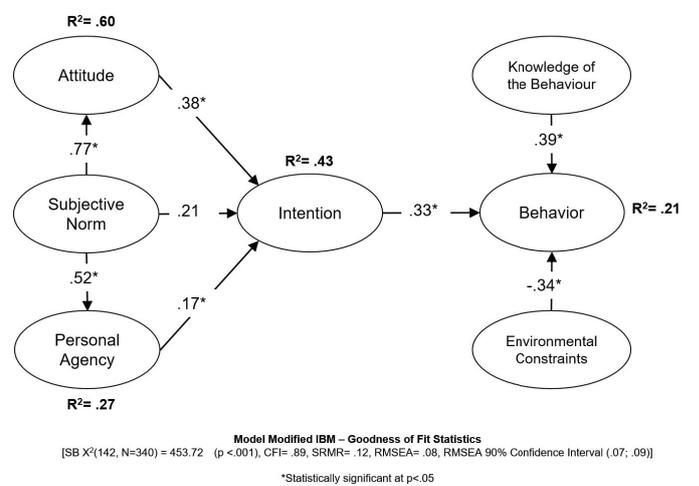


Figure 9: Structural Model 06 (Modified IBM).

10). To keep the nature of variables consistent, continuous and nominal variables were dichotomized. The model yielded an excellent fit [SB  $\chi^2$  (259, N = 340) = 113.61.72 ( $p < .001$ ), CFI = 1.00, SRMR = .06, RMSEA = 0.0, RMSEA 90 percent Confidence Interval (0.0; 0.0)], and produced the highest  $R^2$  for behavior at 26 percent (Table 4 for Estimation of Structural Models). Sociodemographic characteristics significantly explained 62 percent, 35 percent, 48 percent, 75 percent, and 77 percent of attitude, subjective norm, personal agency, knowledge, and environmental constraints, respectively. Being employed had a significant impact on all the dependent variables while marital status and being a woman had a significant impact on personal agency, knowledge, and environmental constraints. Being older than 21 and having higher education only impact subjective norms while attitude was only affected by individuals' employment status. Since there were no modification indices from precursor variables to behavior, it can be said that the assumption for theoretical sufficiency holds.

Compared to TRA and TPB, IBM has the greater explanatory power for behavior, however, with regards to intention, we have not observed a substantive change in the  $R^2$  across models. We compared the  $R^2$  of behavior from the three models (TRA,

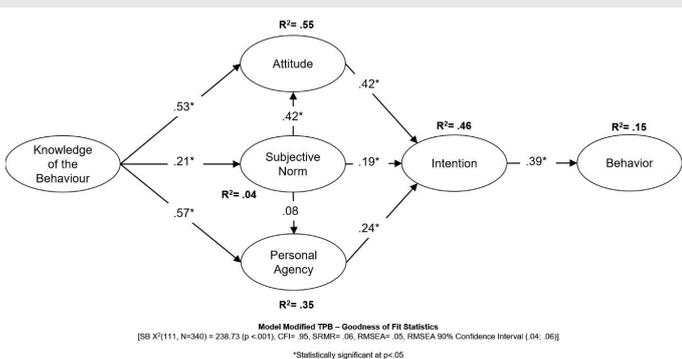
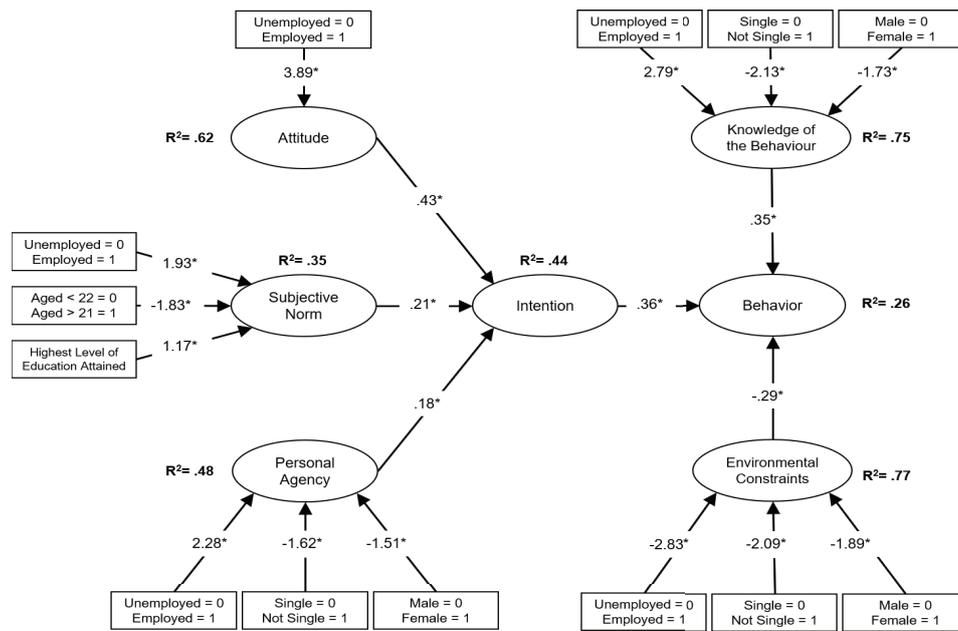


Figure 7: Structural Model 04 (Modified TPB).



**Model IBM with Precursor Variables – Goodness of Fit Statistics**  
 [SB X<sup>2</sup>(259, N=340) = 113.61 (p < .001), CFI= 1.00, SRMR= .06, RMSEA= .00, RMSEA 90% Confidence Interval (.0; .0)]

\*Statistically significant at p<.05

**Note:**

1) Paths were added from all six sociodemographic characteristics to attitude, subjective norm, personal agency, knowledge, and environmental constraints. However, owing to the complex nature of the model, we are only showing paths that were statistically significant.

2) All continuous precursor variables (age, personal income, and monthly household income) were dichotomized as age < 22 = 0 and age > 21 = 1, unemployed = 0 and employed = 1, earning less than \$1800 = 0 and earning more than \$1800=1, respectively. Sex was coded 0 for males and 1 for females. Highest level of education attained was retained as an ordinal variable while marital status was dichotomized as single = 0 and married, engaged, divorced, widowed (not single) = 1.

**Figure 10:** Structural Model 07 (IBM with Precursor Variables).

TPB, and IBM) using Cohen’s (1998)<sup>7</sup> formulae for calculating global and local effect size ( $f^2$ ) (Table 5) [44]. We detected small effect sizes across all models, with IBM producing the greatest effect size ( $f^2 = .14$ ) in comparison to TRA, and TPB producing the smallest effect size ( $f^2 = .02$ ) in comparison to TRA [45]. It is safe to conclude that there is the incremental value of increasing the number of constructs and paths in the models as it contributes to the explanation of behavior.

**Discussion**

This study aimed to understand e-commerce adoption in a developing country while attempting to validate the relationships and scales for reasoned action theories in a non-Western setting.

**Key findings and insights**

**Evolution of reasoned action theories:** The evolution of

<sup>7</sup>Cohen’s formula for local effect size:  $f^2 = (R2_{included} - R2_{excluded}) / (1 - R2_{included})$

Where  $R2_{included}$  is the proportion of variance explained by multiple indicators, and  $R2_{excluded}$  is the proportion of variance explained by any one of the indicators.  $f^2$  would indicate the marginal effect of one of the indicators.

Cohen’s formula for global effect size:  $f^2 = R2 / (1 - R2)$

the reasoned action theories over time has been subjected to a lot of criticism which has resulted in numerous studies excluding volitional and sociodemographic factors, especially in work surrounding e-commerce [20]. However, this study demonstrates that increasing the number of factors significantly contributes to the explanation of behavior while keeping the models parsimonious. Another factor that is often excluded in similar analyses is knowledge; one of the key reasons for its exclusion is issues concerning its measurement [20]. We found that treating knowledge as a latent variable significantly affects its relationships, specifically, its ability to predict behavior.

While increasing the number of factors affect behavior substantively, their impact on behavioral intention was minimal [20]. In tandem with past studies, we found attitude to be the strongest predictor of behavioral intention while subjective norm remained a weak and inconsistent predictor of intention [8,20,46].

**Psychosocial drivers of behavior**

Reasoned action theories over the years have changed substantially over the years to increase our understanding of behavior [8]. However, they do not shed light on the relationships between the distal predictors of behavior [21-24].



**Table 4:** Estimation of Structural Models.

Structural Modelv	Goodness of Fit Statistics					Hayduk's (2006) Blocked-Error R <sup>2</sup>				
	SB $\chi^2$	df	RMSEA	CFI	SRMR	Behavior	Intention	Attitude	Norm	Agency
TRA	96.93	41	0.06	0.97	0.05	0.12	0.40	--	--	--
Modified TRA	83.06	41	0.05	0.98	0.05	0.12	0.40	0.27	--	--
TPB	277.18	112	0.06	0.93	0.08	0.14	0.44	0.62	0.18	0.33
Modified TPB	238.73	111	0.05	0.95	0.06	0.15	0.46	0.55	0.04	0.35
IBM	283.38	137	0.05	0.95	0.06	0.22	0.44	--	--	--
Modified IBM	453.72	142	0.08	0.89	0.12	0.21	0.43	0.60	--	0.27
IBM with Precursor Variables	113.61	259	0.00	1.00	0.06	0.26	0.44	0.62	0.35	0.48

**Table 5:** Effect Sizes for Behavior.

Models	Behavior R <sup>2</sup>	Global Effect Size	Local Effect Size	
TRA (4 factors)	0.12	0.14	TPB – TRA	0.02
TPB (6 factors)	0.14	0.16	IBM – TPB	0.10
IBM (7 factors)	0.22	0.28	IBM – TRA	0.14
IBM <sup>PC</sup> (12 factors)	0.26	0.35	IBM* - IBM	0.05

\*IBM<sup>PC</sup> refers to the IBM model with precursor variables

Several meta-analyses have shown subjective norm to be a poor predictor of intention which has resulted in its exclusion from numerous analyses [12,20,46]. We observed there to be a weak relationship between subjective norm and intention, however, its prediction of attitude remained consistent and strong. Measurement of the norm must be retained as it contributes substantially to the explanation of attitude, and from the standpoint of intervention design, it is important to understand how each construct can be enhanced to ultimately increase behavioral intention and behavior. We also found a strong relationship between subjective norm and personal agency, however that relationship disintegrates when we include knowledge as a predictor of the two aforementioned constructs. The relationships between subjective norm, knowledge, and personal agency require further exploration as this study found the relationship between personal agency and subjective norm to be confounded by knowledge. Furthermore, knowledge of e-commerce substantively impacted the outcome variable as well as its distal predictors. It contributed significantly to the prediction of attitude and personal agency, and to some degree, explained the variation in the subjective norm.

### TRA vs TPB vs IBM

One of the critical points of discussion that emerged from this study is the efficacy of individual behavioral models, specifically “Should we use TRA or TPB or IBM?”. We found all three models to be effective in different settings. TRA is the most parsimonious model, and contributes significantly to the explanation of behavioral intention, hence if a particular study aims to explain behavioral intention without looking at volitional factors, we would recommend TRA. In settings with some or high volitional control, TPB does not contribute significantly to the explanation of the outcome. However, if a study is aimed at understanding the psychosocial drivers of behavior, then the modified TPB may be the most informative model. Moreover, in light of the results of this study, we would like to recommend using IBM when the research

question is aimed at explaining or predicting behavior. The inclusion of sociodemographic variables in SEM and behavior models remains a major question, specifically whether they should be treated as precursor or control variables. Albeit sociodemographic characteristics are not direct determinants of behavior in reasoned action theories, their inclusion in the models as distal predictors contributes substantively to the explanation of behavior, and therefore, an attempt should be made from studies to include them as predictors of the psychosocial drivers of behavior [29].

### Implications for practice

The scales and models validated by the study can be used by e-commerce vendors to increase the adoption of e-commerce, especially in developing countries. Interventions, specifically communication and advertising, can be informed through these models [1,8]. Thus far, a large number of communication strategies in developing countries focus on increasing knowledge and improving people’s attitudes toward e-commerce [5]. This study shows that normative, volitional, environmental, and sociodemographic factors are just as critical, and should be accounted for in the design of an intervention. Communication strategies can use these models as a roadmap for increasing the uptake of e-commerce services. Furthermore, the specific beliefs identified in the study can be targeted by marketers to enhance the respective construct, and subsequently, behavior. The scales validated by this study are parsimonious and can be implemented with ease by practitioners to understand consumer perceptions regarding e-commerce.

### Limitations and suggestions for future research

Since the study only looked at the constructs purported by the reasoned action theories, it did not account for numerous other factors that could affect online behavior such as consumer trust [1-3,15,24]. Many contemporary studies have developed integrated models that account for consumer trust and other factors within the reasoned action frameworks [1], hence future research in similar settings can use the validated scales and frameworks and integrate other variables within it to increase the explanation of behavior. We would also like to highlight various models specific to technology adoption such as Technology Acceptance Model (TAM) and Unified Theory of Acceptance and Use of Technology (UTAUT) [47,48].

One of the major limitations of the study was that behavior was self-reported usage of e-commerce in the last six months. Since behavior was retrospective and monolithic, it restricted



the predictive power of the models. Future research in these settings should look at behavior and perceptions longitudinally, and identify other behaviors such as getting information about e-commerce vendors for inclusion in the model [1].

The study instrument was designed to account for the expectancy-value method of eliciting specific beliefs. However, the expectancy scores (evaluation of the outcome, motivation to comply, and perceived power) were not included in the analysis for two reasons. Firstly, there was little variation in the expectancy scores across the sample hence they were excluded [30]. Secondly, the SEM program in LISREL currently does not provide an estimation methodology that can be used with both continuous and ordinal measures. Since the majority of our data were ordinal, we preserved the ordinal nature of the specific beliefs by not multiplying their scores and transforming them into continuous measures. This allowed us to use the robust DWLS estimation. Furthermore, the study was unable to elicit some key specific measures in the frameworks (self-efficacy, perceived control, experiential attitude, and descriptive norms). Items had been formed to capture these constructs (except for experiential attitude), however, they did not emerge during factor analysis. Future studies can use our validated scales, and refine them to capture these constructs as well.

Moreover, owing to a small and targeted sample, the findings of this study are not generalizable, however, the methodology and the results used in the study can be utilized for future behavioral research in Pakistan.

## Conclusion

This study validated psychometric scales and reasoned action frameworks predicting e-commerce usage for a developing country in Eastern settings. The study further evaluated the evolution of the reasoned action framework and assessed the incremental value of TPB and IBM over TRA. These frameworks increased our understanding of online consumer behavior in the study settings and can be used as communication tools for increasing the uptake of e-commerce adoption.

(Appendix)

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