

Shumaila Y. Yousafzai*

Cardiff Business School, Cardiff University, UK

John G. Pallister

Cardiff Business School, Cardiff University, UK

Gordon R. Foxall

Cardiff Business School, Cardiff University, UK

* Tel.: +44-29-20875843; fax: +44-29-20874419; *Email address:* yousafzais@cardiff.ac.uk (S. Yousafzai)

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A comparison of three models to explain internet banking behavior

Abstract

A key objective of information technology (IT) research is to assess the value of technology for users and to understand the factors that ascertain this value in order to better deploy IT resources. A variety of new models are developed to understand the users' IT behavior; it seems reasonable to examine if the existing models of users' behavior will still apply. This paper uses structural equation modeling to test if three popular models of users' behavior —theory of reasoned action (TRA), theory of planned behavior (TPB), and technology acceptance model (TAM) — can be applied in the internet banking context. The purpose is to understand better the capacity of these theories to predict and explain objectively measured behavior. Unlike other tests of these models, this paper employs independent measures of actual behavior as well as behavioral intention. The results indicate that the TAM is superior to the other models and also shows the importance of trust in understanding the internet banking behavior.

Keywords: Theory of Reasoned Action (TRA), Theory of Planned Behavior (TPB), Technology Acceptance Model (TAM), Internet Banking, Trust

1. Introduction

Explaining user acceptance of new technology is often described as one of the most mature research areas in the modern-day IT literature [e.g. 39]. Researchers over the past years have approached technology acceptance from many levels. Some researchers have examined this issue at the *firm level* by assessing the relationship between IT expenditure and performance [e.g. 8]. A second approach has been to examine the determinants of IT *adoption and usage* by individual users [e.g. 22; 23]. As a key dependent variable in the IT literature, understanding usage is of increasing theoretical interest. In recent years a variety of theoretical perspectives have been applied to provide an understanding of the determinants of IT adoption and usage including the *intention models* from social psychology [16; 64]. This stream of research use behavioral intentions to predict actual use and, in turn, focuses on the identification of the determinants of intention. Theory of Reasoned Action (TRA) [27] and Theory of Planned Behavior (TPB) [2] are especially well-researched intention models that had proven successful in predicting and explaining behavior across a wide variety of domains. From this stream of social psychology research, the Technology Acceptance Model (TAM) [22], an adaptation of TRA, has emerged as a powerful and parsimonious way to represent the antecedents of technology usage.

These multi-attribute models have long dominated attempts to predict technology acceptance behavior [e.g. 14; 31; 32; 40; 65]. The critical methodological examination reported in this paper is a combination of theoretical critique of these models and an empirical investigation of internet banking behavior. The present study is concerned with both the theoretical status of the models under review

and the sphere of human behavior in which they are applied. Therefore, the context of investigation is of central importance to the interpretation of the results. Before introducing the theoretical critique of these models, therefore, it is necessary to summarize briefly the context of internet banking in the UK where the empirical work was undertaken.

1.1 Internet Banking Research

The structure of UK financial services sector has changed markedly over the past twenty-five years under the impact of regulatory, social, economic, and technological forces [42]. The most fundamental force is information technology (IT), which is breaching geographical, industrial, and regulatory barriers, creating new products, services, market opportunities, and developing more information and system oriented business and management processes [48]. Coupled with innovative business thinking, technology is rapidly changing the way personal financial services are designed and delivered. The market for internet banking is forecast to grow sharply in the next three years, affecting the competitive advantage enjoyed by the traditional banks [28]. Growth of the internet, customer comfort with technology, and demographics (younger persons in higher income groups), combined with low cost PC and internet banking solutions, have made that expansion inevitable. The banks have begun to realize that although the internet is simply a delivery channel it is nevertheless an extremely powerful one. Banks, however, must face the fact that technological developments are nothing unless the customers both like and want them. Thus, there will be little return from investments in technology if customers fail to accept or fully utilise its capabilities. Customers' use of internet banking requires acceptance of the technology, which can be complicated because it involves the changing of behavioral patterns and developing a familiarity with both the technology and the financial services. The complex nature of financial services often renders the task of information-search easier than information-evaluation [13]. The combined effect of customers' understanding of both the internet channel and financial services is difficult to foresee, and therefore, there is a need for more research in customers' use of complex services on the internet [46].

The conventional focus of internet banking research is shifting from technological developments to customer behavior. Previous research on internet banking has pointed out that customer acceptance is the key factor in the future development of internet banking and called for further research that facilitates a comprehensive understanding of this customer-based electronic revolution [46]. To develop a deeper understanding of the relationship between customer's beliefs and internet banking acceptance, the next section discusses important theories of technology acceptance.

2. Multi-attribute models in the context of technology acceptance

2.1 The theory of reasoned action

Theory of reasoned action (TRA) is a widely studied model from social psychology that is concerned with the determinants of consciously intended behaviors [27]. From a theoretical point of

view the TRA is intuitive, parsimonious, and insightful in its ability to explain behaviour [6]. The TRA assumes that individuals are usually rational and will consider the implications of their actions “before they decide to engage or not engage in a given behavior” [3: p.5].

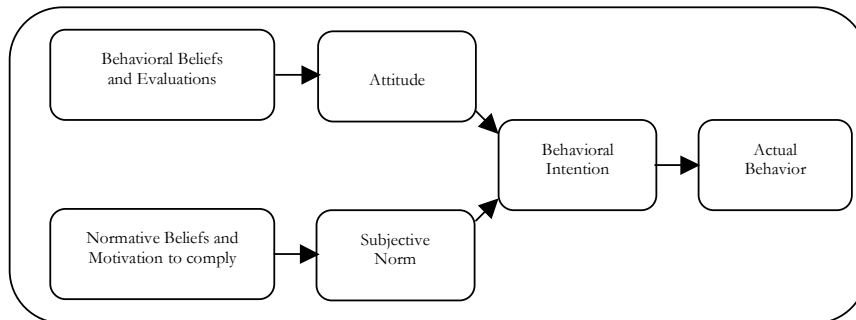


Figure 1: The Theory of Reasoned Action [27]

According to the TRA, presented in Figure 1, behavioral intention is the immediate antecedent of an individual’s behavior. The TRA posits that “most behaviors of social relevance are under volitional control and are thus predictable from intention” [3: p.41]. The theory also suggests that because many extraneous factors influence stability of intention, the relationship between intention and behavior depends on two factors (1) the measure of intention has to correspond to the behavioral criterion in action, target, context, and time; and (2) intention does not change before the behavior is observed [3].

The TRA specifies that behavioral intention is a function of two determinants: a personal factor termed ‘attitude towards behavior’ and a person’s perception of social pressures termed ‘subjective norm’ [27]. Attitude refers to the person’s own performance of the behavior rather than to his/her performance in general [27: p.216]. Subjective norm is a function of a set of beliefs termed as normative beliefs. Normative beliefs “are concerned with the likelihood that important referent individuals or groups would approve or disapprove of performing the behavior” [4: p.455]. According to the TRA, to obtain an estimate of a subjective norm, each normative belief of an individual is first multiplied by motivation to comply with the referent and the cross-product is summed for all salient referent.

Critique of the TRA: TRA is a general model and as such, it doesn’t specify the beliefs that are operative for a particular behaviour [23]. Thus, the researchers using TRA must first identify the beliefs that are salient for subjects regarding the behavior under investigation. Furthermore TRA deals with the prediction rather than outcome of behaviors [30]. In TRA, behavior is determined by behavioral intentions, thus limiting the predictability of the model to situations where intention and behavior are highly correlated. When intention and behavior is measured at the same time then it is not a true test of the model’s power to predict future, but rather a test of the model’s power to predict current behavior. Davies *et al.* [21] suggest that in order to test TRA, actual behavior should be

measured objectively, and unobtrusively, without signalling in any way its connection to the prior intention measurement phase. A further requirement of the TRA is that behavior must be under volitional control. Thus, the TRA is ill equipped to predict situations in which individuals have low levels of volitional control [2].

2.2 The theory of planned behavior

The theory of planned behavior [2], an extension of the TRA tackled the original model's limitations in dealing with behaviors over which people have incomplete volitional control. The TPB suggests that in addition to attitudinal and normative influence a third element, perceived behavioral control (PBC), also influences behavioral intentions and actual behavior (Figure 2).

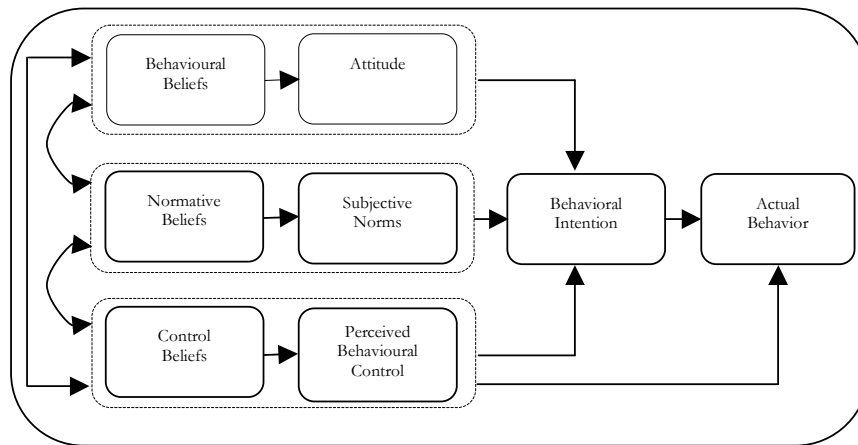


Figure 2: Theory of Planned Behavior [2]

The TPB extends the TRA to account for conditions where individuals do not have full control over the situation. According to the TPB, human action is guided by three kinds of considerations: (i) *behavioral beliefs* about the likely outcomes of the behavior and the evaluations of these outcomes, (ii) *normative beliefs* about the normative expectations of others and motivation to comply with these expectations, and finally (iii) *control beliefs* about the resources and opportunities possessed (or not possessed) by the individual and also the anticipated obstacles or impediments towards performing the target behavior [2]. In their respective aggregates, behavioral beliefs produce a favourable or unfavourable attitude toward the behavior; normative beliefs result in perceived social pressure or subjective norm; and control beliefs give rise to perceived behavioral control (PBC).

Critique of the TPB: TPB is problematic on several grounds. Firstly, like TRA, TPB assumes proximity between intention and behavior, thus, the precise situational correspondence is still vital for accurate prediction [30]. As Eagly and Chaiken [26] points out, the assumption of a causal link between PBC and intention presumes people decide to engage in behavior because they feel they can achieve it. Secondly, the operationalization of the theory is troubled by the problem of measuring PBC directly as opposed to recording control beliefs [49]. Thirdly, the theory introduces only one new

variable when there is continuing evidence that other factors add predictive power over and above the measures formally incorporated in the TPB [21]. For example, Manstead and Parker [49] argue that personal norms and affective evaluation of behavior may account for variance in behavioral intentions beyond that accounted for by the TPB. Ajzen [2] describes the model as open to further expansion, stating that:

...the theory of planned behavior is, in principal, open to the inclusion of additional predictors if it can be shown that they capture a significant proportion of the variance in intention or behavior after the theories' current variables have been taken into account (p.199).

2.3 The technology acceptance model

Originally developed by Davis [22] the technology acceptance model (TAM) has emerged as a powerful and parsimonious model that *belongs* to the information systems (IS) field.

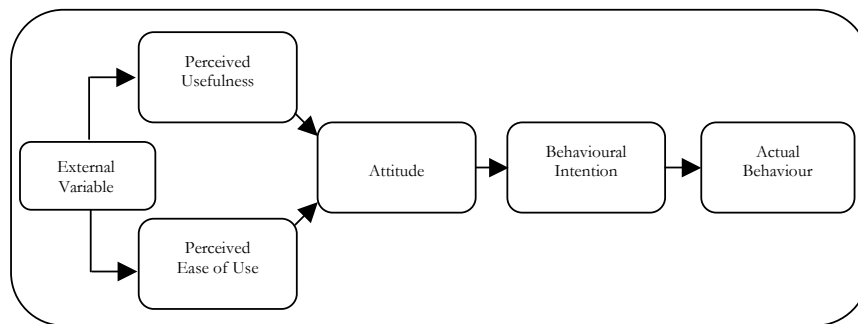


Figure 3: The Technological Acceptance Model [22]

Depicted in Figure 3, TAM adapts the framework of TRA and hypothesize that a person’s acceptance of a technology is determined by his/her voluntarily intentions to use that technology. The intention, in turn, is determined by the person’s attitude toward the use of that technology and his/ her perception concerning its usefulness. Attitudes are formed from the beliefs a person holds about the use of the technology. The first belief perceived usefulness (PU) is the user’s “subjective probability that using a specific application system will increase his or her job performance” [22: p.985]. Initially defined in the context of one’s job performance, PU was later used for any common task in non-organizational settings e.g., Internet shopping [e.g. 31]. Perceived ease of use (PEU), the second belief, is “the degree to which the user expects the target system to be free of efforts” [23: p.985]. PU is influenced by PEU. The strength of such belief-attitude-intention-behavior relationships in predicting behavior largely depends on the degree of measurement specificity attained in a research project [3]. In order to apply these notions to the technology acceptance context, it is necessary to measure beliefs regarding the *use of technology* rather than the *technology itself* i.e., individuals might hold a positive view about a technology without being favourably disposed toward its use.

Davis *et al.* [23] empirically tested the original TAM in a longitudinal study and suggested a revised TAM which they claimed was a more “powerful [model] for predicting and explaining user behavior” [23: p.997]. The attitudinal construct was removed because of the partial mediation of the impact of beliefs on intentions by attitude, a weak direct link between PU and attitude, and a strong direct link between PU and intentions. PEU had a small effect on intentions that subsided over time.

Originally developed to test the acceptance of word processor technology [23], TAM has since been extended to email, voice mail, DBMS [65], personal computer [40], WWW [32], and tele-medicine technology [14], among others. The widespread popularity of TAM, can broadly be attributed to three factors (1) it is parsimonious, IT-specific, and designed to provide an adequate explanation and prediction of a diverse user population’s acceptance of a wide range of systems and technologies within varying organizational and cultural contexts and expertise levels; (2) it has a strong theoretical base and a well researched and validated inventory of psychometric measurement scales, making its use operationally appealing; (3) it has accumulated a strong empirical support for its overall explanatory power [50; 66].

Critique of the TAM: Previous research on TAM has found little similarity between self-reported (subjective) and computer-recorded (objective) measures of IT usage [63; 66]. To be an effective surrogate, self-reported usage must be a valid measure of use correlating strongly with other methods of measuring usage i.e., convergent validity [54]. In addition, it should correlate more strongly with another method of measuring the same construct (e.g., actual usage) than with another construct using the same measuring method (e.g., intentions) i.e., discriminant validity. However, both Straub *et al.* [63] and Szajna [66] found a weak correlation between self-reported and actual usage. Szajna [66] also found that the correlation of self-reported usage with intention was higher than its correlation with actual usage, providing little support for discriminant validity. The weak support for discriminant validity was due to the fact that all constructs of TAM are self-reported and when correlated with self-reported usage, common method variance becomes an important factor. Straub *et al.* [63] argue that “research that has relied on subjective measures for both independent variable...and dependent variables, such as system use...may not be uncovering true, significant effect, but mere artefacts” (p.1336). Another key limitation of TAM is that while it provides a valuable insight into users acceptance and use of technology, it focuses only on the determinants of intention (PU and PEU) and does not tell us how such perceptions are formed or how they can be manipulated to foster users’ acceptance and increased usage [50].

3. A comparison of TRA, TPB, and TAM

3.1 Degree of generality

The first difference between the three models is their varying degree of generality [50]. TAM hypothesises that PU and PEU are always the primary determinants of use decisions; while TRA and TPB uses situation specific beliefs. Therefore, for TRA and TPB, identifying salient beliefs specific to

each context is part of the standard methodology for using the models while it is not essential for TAM. In addition, TPB and TRA are more difficult to apply across different contexts than TAM since, TRA and TPB pilot studies are required to identify different relevant outcomes, reference groups, and control variables [50].

Researchers have debated over time about the relative advantages and disadvantages linked with deriving scales from elicited beliefs, as proposed in TRA and TPB, or to use general beliefs similar to those identified by TAM. The arguments in favour of generic beliefs suggest that, to make the approach consistent and cumulative, and to save time the researchers should use a generic set of beliefs [22; 45]. In contrast, the eliciting of specific beliefs provides a greater guarantee that the beliefs will be relevant to the population [3] and that intervention strategies may be properly targeted at the key issues. The debate over which method is better remains open and may depend largely on whether the researcher's prime focus is with prediction or explanation. Karahanna *et al.* [45], for instance, used both methods and found that the general measures were as good, if not better, at predicting behavior than beliefs elicited for a specific situation. Whereas, Mathieson [50] compared TAM with TPB and found that while TAM was a slightly better predictor of intention, TPB showed better explanatory power due to the specific beliefs that were derived.

3.2 Social variables

The presence of social variable is another difference between the three models. Davis *et al.* [23] did not include social norms in TAM, arguing that social norms are not independent of outcomes. However, social variables can be important if they capture variance that is not already explained by other variables in the model [50]. There could be social effects that are not directly linked to job-related or usefulness-related outcomes. This motivation is more likely to be captured by TRA and TPB than by TAM. In the IT literature to date, the role of subjective norm as a determinant of IT usage is somewhat unclear. Neither Davis *et al.* [23] nor Mathieson [50] found a significant relationship between subjective norm and intentions. However, studies in organisational settings have found subjective norm to be an important determinant of intentions or self-reported usage of IT [e.g. 35].

3.3 Behavioral control

Another major difference between the three models is their measurement of skills, opportunities, and resources needed to engage in a particular behavior i.e. PBC [50]. Ajzen [2] differentiated between internal control factors that are characteristics of the individual (e.g., skill, will power), and external control factors that are specific to each situation (e.g., time, opportunity, cooperation of others). TAM uses PEOU to describe the internal control factors but it does not consider the external factors in an obvious way. Thus, TAM is less likely to identify the distinctive barriers to use since it is designated to operate across many situations. In contrast, TPB is more likely to capture the situation-specific factors as it first identifies the important control variables for each situation.

3.4 Prediction and explanation

The TAM, TRA, and TPB were developed to explain and predict behavior. Each of these models therefore, identifies the determinants of intention and behavior and details the pattern and direction of the causal influences among the variables. However, explanation and prediction mean different things and prediction can occur independently of explanation, but the same cannot be true about explanation itself. Therefore, the explanatory power of these models can only be shown once prediction is established as being accurate. Many of the studies incorporating TAM have focused solely on the determinants of intention to use an information system. By doing so, these studies have not validated their models in respect to the prediction of actual behavior and are consequently unable to show that the explanation is valid for the behavior of interest. Davis *et al.* [23], in their comparison of TRA and TAM, reported that TAM predicted use of a word processing package better than TRA. Similarly, Mathieson [50] found that TAM predicted intentions better than TPB. However, Taylor and Todd [67], in their comparison of TAM, TPB, and DTPB, reported that TPB predicted intention slightly better than TAM. Thus, if the central goal of the study is to predict usage, then it can be argued that is preferable [67]. However, TPB does have a slightly higher explanatory power due to its inclusion of constructs such as subjective norm and PBC.

3.5 Measurement instruments

The availability of sound instruments is an important property of TAM, since it simplifies the comparison of results across studies and supports cumulative theoretical development. The original instrument for measuring PU and PEU was developed and validated by Davis [22], and Davis *et al.* [23], and replicated by Mathieson [50], and Hendrickson *et al.* [36]. The scales have also exhibited a high degree of reliability, and convergent, discriminant, and nomological validity [25].

3.6 Parsimony

While all the three models are relatively parsimonious, the 5-variable TAM is more parsimonious than the 6-variable TRA and the 8-variable TPB. In fact, TPB with 6 determinants of intention is considered twice as complex as TAM which has only 3 determinants of intention. Taylor and Todd [67] found that while the 5-construct TAM explained 34% of the variance in usage, the 13-construct DTPB explained 36%, a modest increase. So the small increase in predictive power comes at the cost of a large increase in complexity. For practical applications of the models, parsimony may be more heavily weighted, while in pursuing a fuller understanding of the phenomena, a degree of parsimony can be sacrificed [67]. Thus, in general, TAM maintains a higher parsimony by sacrificing some explanatory power and is less costly to apply in most contexts.

4. The role of trust in internet banking acceptance

The banking industry is strongly associated with high levels of trust related to security and privacy issues in the physical environment. However, this association has not yet been translated in the

electronic world to its full potential. The lack of the physical presence and interaction between the bank personnel and the customer renders a unique environment, in which trust is of vital importance. Customers are reluctant to adopt internet banking because of security and privacy concerns [47]. Thus, the lack of customer trust, both in the attributes of the bank and in the overall online environment has been, and remains, an obstacle in the wide spread adoption of internet banking. Customers' trust is identified as an important future challenge for internet banking [5]. Banks can build mutually valuable relationships with their online customers through a trust-based collaboration process [24]. However, the way in which trust may be gained and the impact it has on internet banking is not yet well understood [43]. Trust in internet banking is a new and emerging area of interest in the field of marketing of financial services research. Extant literature on trust related to internet banking is scarce and focused on more general issues of e-commerce.

Previous research suggests that trust, in the context of e-commerce adoption, should be treated as a multi-dimensional concept [31]. The present study treats the perceptions of privacy and security as antecedents of trust because research has asserted customers' concerns of privacy and security as leading barrier for online trust [37]. Cheskin [15] suggests that the 'first and most necessary step' in establishing customers' trust is to provide them with the guarantee that their personal information will be safeguarded. Other researchers have also reinforced this belief affirming that only after security and privacy concerns have been addressed, customers will consider other web-features to determine the extent to which they can trust and/or feel comfortable transacting with the web merchant [e.g. 12; 24]. Belanger *et al.* [10] pointed to the deficiency of existent e-commerce literature for conceptualising security and privacy as distinct issues. This paper treats privacy and security as two separate constructs and they are defined similarly to the distinction used in identifying 'environmental control' as separate from 'control over secondary use of information' [37]. Environmental control is referred to customers' concerns with electronic transfer of information due to expectation of threats to online security, whereas control over secondary use of information is concerned with privacy of their information. It is proposed that customers will develop trust on internet banking transactions when they believe that their information will not be viewed, corrupted or stored during transactions by parties other than the bank (perceived security), and that the collection, subsequent access, use and disclosure of their information will be consistent with their expectation (perceived privacy). Thus, suggesting that customers' perceptions of security and privacy are positively related to their trust.

4.1 Perceived security

Security has been widely recognised as one of the most significant barriers to the adoption of internet banking [5; 20]. Security in e-commerce is being defined as a threat which creates "circumstance, condition, or event with the potential to cause economic hardship to data or network resources in the form of destruction, disclosure, modification of data, fraud, and abuse" [44]. In the

present study perceived security is defined as customers' perception of the degree of protection against above mentioned threats.

Literature suggests that security can be guaranteed with adequate encryption, digital signatures, and firewalls [9], albeit consumer's perception of online security is a different phenomenon. Even if it is feasible to objectively measure the degree of security in every transaction, it is unclear whether this measurement would readily correspond to the consumers' perceptions of security. In the risky environment of e-commerce transactions the objective, scientific perspective is usually different from the subjective, intuitively grounded one [59]. The present study measures the customers' subjective perspective about secure internet banking transactions based on their perceptions of timely, accurate, and safe data transmission. Following Ratnasingham [57] it is proposed that when customer develops positive perceptions of security, the trust and confidence in the relationship will also increase and will promote open, substantive, and influential information exchange.

4.2 Perceived privacy

Perceived privacy is the consumer's ability to control (a) presence of other people in the environment during a transaction; and (b) the dissemination of provided information [34]. The present study defines perceived privacy as customers' perception regarding their ability to monitor and control the collection, use, disclosure, and subsequent access of their information provided to the bank during an online transaction. The conventional marketing approach suggests that expressions of control (awareness of information collected and its usage) are the predominant influences on the degree to which customers experiences privacy concern [60].

Consumers in online environments perceive little control over information privacy and this has a striking influence on their willingness to engage in trusting relationships with web merchants. Using customers' data for purposes other than original transaction is seen as an invasion of their privacy and an illegitimate use of information on part of the company. The financial services customers are more reluctant to use these services from the fear that their financial life will become an open book to the Internet universe [11]. There is thus a risk of loss of privacy, which is a significant factor in building trust. The literature has described the willingness to assume the risk of disclosure as a dimension of trust [53]. Accordingly, by disclosing privacy practices, the bank can significantly ease customers' privacy concerns and can build a more trusting environment for online transactions. Trust arising from perceived privacy could best be achieved by allowing the balance of power shift towards a more cooperative interaction between online business and its customers [37]. At a minimum, it means market-driven industry acceptance, enforcement of opt-out policies, and recognising customers' right to data ownership.

5. Research Methodology

5.1 Models comparison

The previous sections reviewed and compared three principal theoretical models used in technology acceptance research. It appears that there are only seven model comparison studies in the literature [23; 50; 67; 58; 14; 56; 33]. These comparisons focused on student and workplace mandatory settings and measured either intention or subjective usage behavior. The present study will compare the TRA, the TPB, and the TAM in the context of objectively measured internet banking behavior, attempting to seek answers to the following questions: Will existing behavioral models work in an environment that they were not developed to describe? Which of these three models best explains the actual internet banking behavior? Answering these questions requires a fair comparison, that is, a comparison that is not biased in favour of one model or another.

5.1.1 Ensuring a fair comparison

It is important to consider if models are theoretically comparable before they are empirically compared [52]. Since the TPB and the TAM are derivatives of the TRA and consequently use many of the same constructs, an empirical comparison is justified. Further, the condition of procedural equivalence for a fair comparison was also maintained [19]. The first requirement for procedural equivalence is that the boundary conditions of the theories should be observed. The notable difference in boundary conditions is that the TRA and the TPB are more specific. In the present study a group of homogeneous subjects (internet banking users of HBOS) indicated actual behavior (*action*) towards use of internet (*target*) for conduction their banking transactions (*context*) within two month time (*time*). This situation is specific enough for the TRA and the TPB and also respects the boundary conditions of the TAM. Second, equal attention was given to measurement. The same measures are used for all models for attitude, intentions, and actual usage. The TAM constructs PU and PEU were measured using instrument developed by Davis [22].

The propositions evaluated and the derivative hypotheses by means of which these theories will be tested are as following:

Proposition One: The TRA predicts internet banking behaviour.

- H1.1: contends that intention to use internet banking significantly predicts the actual use of internet banking.
- H1.2: contends that attitude towards the use of internet banking and social normative influences significantly predict intention to use internet banking.

Proposition Two: The TPB predicts internet banking behaviour.

- H2.1: contends that intention to use internet banking and PBC significantly predicts the actual use of internet banking.
- H2.2: contends that attitude towards the use of internet banking, social normative influences, and PBC significantly predict intention to use internet banking.

Proposition Three: The TAM predicts internet banking behaviour.

- H3.1: contends that intention to use internet banking significantly predicts the actual use of internet banking.
- H3.2: contends that PU and PEOU of internet banking significantly predict intentions to use internet banking.

Proposition Four: All three models (TRA, TPB, and TAM) are appropriate to explain the internet banking behaviour.

- H4.1: contends that TPB and TAM will explain more of the variance in internet banking usage than the TRA.
- H4.2: contends that TAM will explain more of the variance in internet banking usage than the TPB.

Proposition Five: The incorporation of trust will increase the sufficiency of the TAM.

- H5.1: contends that trust has a positive influence on behavioural intention.
- H5.2: contends that perceived privacy has a positive influence on trust.
- H5.3: contends that perceived security has a positive influence on trust.

5.2 Questionnaire development process

Postal questionnaire survey was used as primary data collection method. In the final study, a cover letter signed by Head of marketing Section of the business school and a letter of recommendation signed by Senior Analyst in the E-Commerce Channel Development of the Halifax Bank was sent together with the questionnaire to motivate potential respondents' participation in the research and confirm the confidentiality and credibility. A postage paid return envelop was also enclosed. The operationalization of the study's constructs is explained in the following paragraphs. Respondents were asked to indicate agreement with each statement in a measure using a seven-point Likert-type scale with anchors of (1) 'strongly agree' to (7) 'strongly disagree'

(1) Operationalization of Internet Banking Behavior: Actual behavior for the use of six internet banking services was computer recorded by the bank over a time period of 8 weeks. The internet banking services were (1) basic account information and checking balance; (2) bill payment; (3) list of recent transactions; (4) viewing statement; (5) transferring money; and (6) setting up/cancelling standing orders/direct debits. The present study did not rely on self-reported behavior because the aim of this study was to test the intention-behavior framework dictated by Ajzen and Fishbein [3]. In order to achieve this it was critical that the participants were unaware that both their actual behavior and intention to use were being monitored simultaneously. Researchers have observed that that studies that

has relied on subjective measures may not be uncovering true, significant effect, but mere artefacts [63].

(2) Operationalization of Behavioral Intention: Ajzen and Fishbein [3] argue that the strength of intention-behavior relationships largely depends on the degree of measurement specificity attained in a research project. Therefore, in order to apply these notions to the internet banking context, the intentions and beliefs were measured regarding the *use of internet banking* rather than directed toward *the internet banking itself*.

(3) Operationalization of Attitude: Following the definition in the TRA, attitude is measured in terms of individual preferences and interests via feelings and evaluations regarding internet banking outcomes.

(4) Operationalization of Subjective Norms: In accordance with the recommendations by Ajzen and Madden [4], subjective norms was operationalized by measuring normative beliefs and motivations to comply. *Normative beliefs* were measured by asking respondents' beliefs about whether specific others (friends, family, and colleagues) thought internet banking was important. Respondents' *motivation to comply* measured their compliance with the wishes of their friends, family, and colleagues. A measure of *subjective norm* was then obtained by multiplying the normative belief by the motivation to comply and summing the resultant products.

(5) Operationalization of PBC: Respondents' PBC is measured in terms of resources and opportunities possessed and it also considers the anticipated obstacles or impediments [2].

(6) Operationalization of PU and PEOU: The operationalization of PU and PEOU is based on the original scale developed by Davis [22].

(7) Operationalization of Trust: Trust is measured as a second-order construct and operationalized as 'overall trust' on service (internet banking), entity (bank), and medium of transaction (internet).

(8) Operationalization of Perceived Security: The operationalization of perceived security is based on Ratnasingham's [57] and Chellappa's [17] definitions of e-commerce security, as the protection of information exchanged during electronic transaction from the threats and risks of *transactional integrity*, *authentication*, and *authorisation*. Transactional integrity is the belief that the information will not be created, intercepted, modified or deleted illicitly. Authentication belief assures the customers that only genuine transactions will be worthy of acceptance. Authorisation belief will establish that the parties to an electronic transaction are who they claim they are.

(9) Operationalization of Perceived Privacy: The operationalization of perceived privacy is based on the dimensions of *awareness of information collection*, *information usage beyond transaction*, *access*, and *enforcement* [17; 61; 62]. Access refers to giving customers the right to verify or correct any information that they have already provided during online transaction. Enforcement ensures the existence of an effective mechanism to address any potential violation of customers' privacy.

5.3 Data collection and non-response bias

The data was collected through questionnaires sent to 2000 internet banking users of Halifax Bank. 441 completed questionnaires were received, giving a response rate of 22.05%. Mann-Whitney-U and Wilcoxon-W test were conducted to check non-response bias and the results yielded no significant differences ($p = 0.05$) between the last and the first quartile respondents. The demographic profile of the survey respondents (Table 1) shows that 43.7% of the respondents were female and 56.3% male. The largest age group consisted of those aged 26-45 years (41.6%), followed by the age group 46-60 years (36.6%). The average internet experience of the respondents was 2.59 years and the average internet banking experience was 1.46 years.

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6. Data analysis

The data analysis was carried out in accordance with a two-step methodology of structural equation modelling where the measurement model is first developed and evaluated separately from the full structural equation model [1].

6.1 Measurement model

Accordingly, the first step in the data analysis was to establish the unidimensionality, reliability, convergent and discriminant validity of the constructs with confirmatory factor analysis (CFA) using the AMOS software (version 5). Table 2 summarizes the CFA results.

---INSERT TABLE 2 ABOUT HERE---

Table 2 suggests that all standardised regression weights are greater than 0.60 and the critical ratios are significant at $p = 0.001$. The adjusted χ^2 (χ^2/df) is 3.76 and other goodness-of-fit statistics indicates that the model achieved a good fit to the observed data thus satisfying the conditions of unidimensionality. Turning to assessment of measure of reliability, Table 2 indicates that reliability in individual item based on R^2 values for all indicators is greater than 0.50., except PPRIV1 (0.47). In terms of composite values, the constructs exceed Bagozzi and Yi's [7] recommended value of 0.60. In addition, reliability evaluation based on average variance extracted (AVE), revealed that all constructs exceed 0.50 [29]. This implies that the variance captured by the construct is greater than the variance accounted for by measurement error. Furthermore, the Cronbach alpha values for all the constructs exceed 0.70. Concerning discriminant validity, Table 3 suggests that the correlation coefficients among the latent constructs do not exceed the cut-off point of 0.85. Additionally, comparison between square root of AVE and correlations in Table 3 also establishes discriminant validity.

---INSERT TABLE 3 ABOUT HERE---

6.2 Structural model results

Following the satisfactory model evaluation results, this section will use SEM to examine and compare TRA, TPB and TAM to find which model performs well in explaining the internet banking behavior. Table 4 summarizes the degree to which each model fit the data.

---INSERT TABLE 4 ABOUT HERE---

The fit statistics in Table 4 indicate that the TRA provides a poor fit to the data. The fit of TPB is moderately comparable to the TAM with a slightly better RMSEA, suggesting that even when the increased complexity of the TPB is taken into consideration, the fit of the TPB model is at least equivalent to the TAM. TAM and trust enhanced TAM appears to be superior to TPB and TRA in explaining behavioral intention and actual use of internet banking; that is, $R^2_{BI} = 0.75$ and $R^2_{USE} = 0.67$ for TAM, whereas $R^2_{BI} = 0.39$ and $R^2_{USE} = 0.60$ for TPB, and $R^2_{BI} = 0.37$ and $R^2_{USE} = 0.47$ for TRA. Clearly, trust enhanced TAM not only provides the best fit to the data with a comparative fit index (CFI) well above 0.90, it also explains 67% of the variance in actual behavioral.

Table 5 shows the path coefficient for each model, together with their respective significance. The path significance is consistent across all the investigated models. That is, a path found to be significant in one model remained so in the other models and, similarly, a path not significant in one model remained insignificant in others. According to the TRA, TPB, and TPB the immediate determinant of human behavior is behavioral intention. The results from the structural model (Table 5) support this association for all the models. PU was a significant determinant of behavioral intention in both TAM (0.89) and trust enhanced TAM (0.90). However, the relationship between intentions and PEOU is not statistically significant. PU is significantly predicted ($R^2_{PU} = 50\%$) by PEOU (0.56) in TAM. In addition path from PBC to behavioral intention was significant in TPB. The path from subjective norm to behavioral intention was not significant in either TPB or TRA. The results also suggest a positive albeit weak association between attitude and behavioral intention. Finally, a total of 78.2 % of variance in trust on internet banking transactions is predicted by perceived security (0.396) and perceived privacy (0.271).

---INSERT TABLE 5 ABOUT HERE---

7. Discussion

A major strength of this study is that it studies the actual ‘*objective*’ internet banking behavior without signalling its relationship with the intention measurement phase, whereas, past research on technology acceptance either indicates acceptance by inferring from the respondents’ intentions, in the sense that intention is positively related to actual use, or it measures ‘*subjective*’ self-reported actual behavior. The present study contributes to previous literature by supporting the proposition that behavioral intention to use an IT do affect objectively measured future IT use. The results suggests that TAM is superior to both the TRA and the TPB for explaining the variance in actual behavior and in terms of model fit — at least within internet banking context. The results beg the obvious question

that why did TAM outperform the TRA and TPB? A possible explanation could be due to TAM's use of two specific beliefs —PU and PEOU— that can be applied to any technology acceptance context. On the other hand, the TRA and the TPB requires the researcher to 'reinvent the wheel' and elicit unique beliefs for each situation. In addition, TAM benefits by not considering the consistently unreliable—at least in researchers' ability to consistently capture—construct subjective norms. Furthermore, both TAM and TPB are advanced theories derived from TRA, it was expected that these two theories should explain or predict the actual behavior more accurately than TRA. Finally, internet banking is technology-related usage behavior and TAM was specifically developed to explain such behaviors.

The study provides empirical evidence that intentions translate over time into actual behavior — as assumed, but seldom shown, in e-commerce research — thus validating the practical utility of the proposed model. The results also suggest that integration of trust with the TAM constructs under TRA aegis is not only theoretically appealing, but also empirically significant, since it explains why the variance for intention is much higher than indicated by previous TAM studies. The original conceptualisation of TAM was in keeping with TRA, where beliefs (PU and PEU) were hypothesised to be completely mediated by attitude towards using technology. However, a subsequent study conducted in volitional environment confirmed the possibility of a direct belief-intention linkage and demonstrated that the explanatory power of the TAM is equally good and it is more parsimonious without the mediating attitude construct [23]. The results from present study also confirm this finding thus suggesting any observed relationship between attitude and intention to be spurious.

Judged by its effect on intention, PU was found to be the most significant factor, confirming the possibility of extending the TAM into the internet banking context to explain its acceptance. However, the effect of PEU on intentions was not significant. A possible explanation could be given by Davis [22], who argued that PEU may act indirectly on intentions through PU. The results suggest that PEU has an indirect effect on intention via PU on which it has a strong direct effect, thus allowing the inference that PEU fosters the usefulness of internet banking. The non-significant link between PEU and intention is also consistent with prior research that suggests that ease of use initially influences potential adopters' usage intentions [32]. Similarly in many cases the new technology is adopted because of its extrinsic aspect (captured through PU) and not its intrinsic aspect [32]. Thus, PEU will only affect the use when the intrinsic character of the technology contributes to the actual outcome. The sample for the present study consisted of experienced internet banking users, and as users gain experience with the technology more cognitive considerations emerge and gain significance in determining the intended behavior.

The findings, related to trust, reinforced the interpretation that trust, in the context of the internet-related behaviors, is a multi-dimensional construct and confirms two antecedents of trust: (1) belief that there are safety mechanisms built into the website (perceived security), and (2) belief that the transaction information will not be used or shared with other without the consent of customers

(perceived privacy). The study also highlights the importance of using security and privacy as two distinct concepts, even though they are conceptually related.

8. Implications for research and practice

The present study has significant implications for research on online customer behavior. With the arrival of e-commerce the notion of uncertainty is introduced into technology acceptance because customers are required to use internet in order to communicate, collaborate, and transact within and without organizational barriers, thus transcending secure face-to-face interaction [55]. While conventional customer behavior is well described by economic and marketing theories, overwhelming evidence suggests that technology-related variables have become as important as traditional factors in predicting online customer behavior [e.g. 41; 51; 55]. Findings from the present study suggest that it is crucial for customer behavior researchers to examine the role of uncertainty in situations where trust and perceived risk are likely to affect system use, for example virtual teams and organizations, inter-organizational collaboration, and B2B/B2C/C2C transactions.

The most significant implication for the banking sector is the need to recognize that internet banking acceptance should be managed with the twofold objectives of creating a useful service and of building a trusting relationship with the customers. While the explicit essence of the customer's relationship with the bank is to get a useful and efficient internet banking service, the customer's trust and its antecedents are an essential aspect of this relationship and contribute to its value. The banks should build websites that are not only useful and easy to use, as TAM suggests, but it should also include trust-building mechanisms [e.g. 68].

9. Limitations and directions for future research

There is always the issue of generalisability in the customer behavior studies, and the present study is no exception. Future research needs to determine the extent to which the findings of the present study can be extended to include other persons, settings, and times. One way of doing this is to extend the work to lesser known internet banking websites. The data for the present study was collected from a single high street bank, and one that has a reputation as an established bank. The results might be different for pure play internet banks, such as EGG (www.egg.co.uk) and CAHOOT (www.cahoot.co.uk). Secondly, the sample comprised only active internet banking users. Whether these results can be generalized to non-users or to dormant users of internet banking will require additional research. Thirdly, the measures of all the constructs of the study, except actual internet banking usage, were collected at the same point in time and via the same instrument, so the potential for common method variance exists [63]. There were, however, no signs of lack of discriminant validity among the principal constructs, the usual sign of common method variance. Nevertheless, future research could employ a more controlled experimental manipulation to avoid allowing the respondents to provide uniform responses across all constructs. Finally, due to the cross-sectional nature of the study, causality can only be inferred through the theory. To show causation, additional

longitudinal research, possibly even in a quasi-experimental design, is necessary [18]. A topic that requires additional research is the conceptualization of trust. Additional research could include other aspects of trust that have been suggested, but are not commonly applied, for instance, reliability and loyalty [38] and predictability [51]. Trust may also be influenced by a variety of other elements that are beyond the relationship itself, such as personality-related dispositions, such as disposition to trust and belief in humanity [51] as well as vendor characteristics such as size and reputation [41].

On the other hand, the study has several advantages over earlier studies. Not only was internet banking behavior objectively observed, it was done in such a way that respondents who identified their intention to use internet banking did not know their actual behavior would be monitored. In addition this study met the conditions set out by Ajzen and Fishbein [3] for testing TRA, that is precise situational correspondence and continuity between behavior and intention.

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Table 1
Profile of Survey Respondents

| Category | Statistics |
|-----------------------------------|-------------|
| Gender | |
| Male | 245 (56.3%) |
| Female | 190 (43.7%) |
| Age | |
| 18-25 Years | 43 (9.9%) |
| 26-45 Years | 181 (41.6%) |
| 46-60 Years | 159 (36.6%) |
| Above 60 Years | 52 (12%) |
| Highest Educational Qualification | |
| Secondary School/College | 177 (40.7%) |
| Professional Diploma | 91 (20.9%) |
| University (Undergraduate) | 83 (19.1%) |
| University (Post Graduate) | 84 (19.3%) |
| Occupation | |
| Student | 21 (4.8%) |
| Housewife/Husband | 26 (6%) |
| Retired/Pensioner | 60 (13.8%) |
| Professional | 174 (40%) |
| Clerical/Secretarial Staff | 49 (11.3%) |
| Technical Staff | 31 (7.1%) |
| Self Employed | 35 (8.0%) |
| Others | 39 (9.0%) |
| Internet Use | 353 (81.1%) |
| Home | 82 (18.9%) |
| Office | --- (0%) |
| Internet Café | |
| Internet Experience | |
| Under 1 Year | 5 (1.6%) |
| 1-5 Years | 210 (48.3%) |
| 6-10 Years | 173 (39.8%) |
| over 10 Years | 45 (10.3%) |
| Internet Banking Experience | |
| 1-3Years | 263 (60%) |
| 4-6 Years | 145 (33%) |
| over 7 Years | 27 (6%) |
| Internet Shopping | |
| Yes | 406 (93.3%) |
| No | 29 (6.7%) |
| Largest amount spent on Internet | |
| Nothing | 29 (6.7%) |
| Under 50£ | 51 (11.7%) |
| £51-100 | 62 (14.3%) |
| over £ 100 | 293 (67.3%) |

Table 2
CFA Results for Measurement Model

| Construct | | Regression Weight | R ² | α | CR AVE |
|-----------------------|--------|-------------------|----------------|----------|--------|
| Intention | INT1 | 0.75** | 0.64 | 0.84 | 0.91 |
| | INT2 | 0.85* | 0.73 | | |
| | INT3 | 0.80* | 0.60 | | |
| Attitude | ATT1 | 0.80** | 0.65 | 0.71 | 0.80 |
| | ATT2 | 0.62** | 0.78 | | |
| | ATT3 | 0.57** | 0.74 | | |
| PBC | PBC1 | 0.68** | 0.56 | 0.78 | 0.80 |
| | PBC2 | 0.86** | 0.74 | | |
| | PBC3 | 0.71** | 0.51 | | |
| SN | SN1 | 0.73** | 0.54 | 0.74 | 0.84 |
| | SN2 | 0.80** | 0.64 | | |
| Perceived Usefulness | PU1 | 0.86** | 0.74 | 0.89 | 0.94 |
| | PU2 | 0.85** | 0.73 | | |
| | PU3 | 0.79** | 0.63 | | |
| | PU4 | 0.79** | 0.62 | | |
| Perceived Ease of Use | PEU1 | 0.77** | 0.60 | 0.93 | 0.96 |
| | PEU2 | 0.78** | 0.60 | | |
| | PEU3 | 0.84** | 0.70 | | |
| | PEU4 | 0.92** | 0.85 | | |
| | PEU5 | 0.94** | 0.89 | | |
| Trust | TSRT1 | 0.94** | 0.81 | 0.92 | 0.96 |
| | TRST2 | 0.84* | 0.71 | | |
| | TRST3 | 0.90* | 0.95 | | |
| Perceived Security | PSEC1 | 0.61* | 0.52 | 0.92 | 0.94 |
| | PSEC2 | 0.62* | 0.58 | | |
| | PSEC3 | 0.73* | 0.53 | | |
| | PSEC4 | 0.69* | 0.84 | | |
| | PSEC5 | 0.91* | 0.83 | | |
| | PSEC6 | 0.88* | 0.77 | | |
| | PSEC7 | 0.95** | 0.90 | | |
| Perceived Privacy | PPRIV1 | 0.61* | 0.47 | 0.81 | 0.91 |
| | PPRIV2 | 0.80* | 0.63 | | |
| | PPRIV3 | 0.90* | 0.82 | | |
| | PPRIV4 | 0.88** | 0.77 | | |
| | PPRIV5 | 0.61* | 0.47 | | |

Overall Goodness-of-fit Indices

$\chi^2/df = 3.76$

GFI = 0.91; CFI = 0.96; TLI = 0.94

RMSEA = 0.07

NOTE: α = Cronbach alpha; AVE = Average Variance Explained; CR = Composite Reliability

* Significant at $p < 0.001$

** Significant at $p < 0.01$

Table 3
Descriptive Statistics, Inter-construct Correlations and Square root of AVE

| Constructs | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|--------------------------|------|------|------|------|------|------|------|------|------|
| 1. Behavioral Intentions | 0.87 | | | | | | | | |
| 2. Perceived Usefulness | 0.42 | 0.89 | | | | | | | |
| 3. Perceived Ease of Use | 0.33 | 0.77 | 0.91 | | | | | | |
| 4. Trust | 0.61 | 0.62 | 0.60 | 0.94 | | | | | |
| 5. Perceived Security | 0.27 | 0.58 | 0.58 | 0.76 | 0.85 | | | | |
| 6. Perceived Privacy | 0.22 | 0.44 | 0.50 | 0.59 | 0.60 | 0.87 | | | |
| 7. Subjective Norm | 0.21 | 0.29 | 0.24 | 0.21 | 0.21 | 0.21 | 0.75 | | |
| 8. Attitude | 0.34 | 0.72 | 0.60 | 0.54 | 0.50 | 0.35 | 0.46 | 0.84 | |
| 9. PBC | 0.25 | 0.55 | 0.63 | 0.62 | 0.64 | 0.74 | 0.31 | 0.75 | 0.69 |
| <i>Mean</i> | 3.35 | 2.84 | 3.20 | 3.20 | 3.77 | 3.65 | 2.77 | 3.59 | 2.84 |
| <i>SD</i> | 1.32 | 1.58 | 1.56 | 1.60 | 1.59 | 1.67 | 1.27 | 1.77 | 1.58 |

NOTE: Diagonal elements are the square root of AVE; off-diagonal elements are correlations between constructs.

Table 4
Overall fit and explanatory power of the models

| | Recommended Value | TRA | TPB | TAM | TAM with Trust |
|-------------------|-------------------|------|------|------|----------------|
| Fit Index | | | | | |
| Chi-square/df | $x \leq 3.0$ | 5.86 | 4.59 | 2.9 | 2.1 |
| CFI | $x \geq 0.90$ | 0.77 | 0.87 | 0.91 | 0.95 |
| GFI | $x \geq 0.90$ | 0.49 | 0.79 | 0.89 | 0.94 |
| RMSEA | $x \leq 0.08$ | 0.18 | 0.07 | 0.08 | 0.07 |
| Explanatory Power | | | | | |
| R^2_{USE} | | 0.37 | 0.39 | 0.51 | 0.67 |
| R^2_{INT} | | 0.47 | 0.60 | 0.57 | 0.75 |
| R^2_{PU} | | --- | --- | 0.50 | 0.55 |

Table 5
Significance and Strength of individual paths

| Hypothesized relationships | TRA | TPB | TAM | TAM with Trust |
|-----------------------------------|--------|--------|--------|----------------|
| Behavioral Intention → Actual Use | 0.64** | 0.63** | 0.67** | 0.67** |
| PBC → Actual Use | --- | 0.40** | --- | --- |
| Attitude → Behavioral Intention | 0.21* | 0.27* | --- | --- |
| PU → Behavioral Intention | --- | --- | 0.89** | 0.90** |
| PEOU → Behavioral Intention | --- | --- | 0.11 | 0.02 |
| SN → Behavioral Intention | 0.17 | 0.18 | --- | --- |
| PBC → Behavioral Intention | --- | 0.43** | --- | --- |
| PEOU → PU | --- | --- | 0.56** | 0.56** |
| Trust → Behavioral Intentions | --- | --- | --- | 0.37** |
| Perceived Security → Trust | --- | --- | --- | 0.40** |
| Perceived Privacy → Trust | --- | --- | --- | 0.27** |

NOTE: ** Significant at $p < 0.001$

* Significant at $p < 0.01$