

Investigating Customers' Continuous Trust Towards Mobile Banking Apps

Maohao Che

Nanyang Technological University

Sze Yee Ashley Say

Nanyang Technological University

Han Yu

Nanyang Technological University

Qingji Zhou

Tianjin University

Jared Shu

WeResearch, Webank

Wen Sun

WeResearch, Webank

Xi Luo

WeResearch, Webank

Hong Xu (✉ xuhong@ntu.edu.sg)

Nanyang Technological University

Article

Keywords: Consumers' trust, mobile banking, structural equation modelling (SEM), continuous trust, post-use trust

Posted Date: June 10th, 2022

DOI: <https://doi.org/10.21203/rs.3.rs-1675411/v1>

License:  This work is licensed under a Creative Commons Attribution 4.0 International License.

[Read Full License](#)

Abstract

Gaining continuous trust from mobile banking customers is a critical step in retaining customers for their usage of the provided, and continually evolving services. The current study aims to investigate how customers' continuous trust is formed at the post-use stage. Online survey responses from 450 frequent mobile banking users are collected. The data was analysed using structural equation modelling (SEM) based on a proposed model that predicts trust. The findings successfully validated the model and its reduced form. Based on which, customers' continuous trust can be predicted by mobile banking apps' perceived ease of use, privacy assurance and security features, organisation reputation, customer support, and customers' previous experience. Furthermore, the interactive relationships among these proposed factors are proposed and validated in the model. In studying trust in mobile banking past the initial adoption stage, we present new knowledge on how various factors might interactively inform customers' continuous trust. It adds to the scant literature on consumers' continuous trust.

1 Introduction

Today, over 6.3 billion smartphone users have been reported worldwide [1], with a projected growth of almost hundreds of millions more per year. With the increased utilisation and development of fifth-generation (5G) mobile communication technology [2], wireless communication is seeing similarly rapid growth in its speed and reliability [3]. Jointly, these recent technological advances have effectuated the shift of consumer demand across various sectors towards online transactions, greatly enhancing user mobility and access [4]. Many organisations across industries have identified the need for quick and efficient reforms of traditional services towards digitally-based interactions, such as mobile banking [5].

Banks have been among the first in the financial service sector to rapidly transform and adapt interpersonal services to mobile-based channels [6]. This advancement has revolutionised the industry both for operating firms and their general user base. On the one hand, this has driven firms to optimise financial and customer services to retain users and remain competitive within the industry in times of fierce technological innovation. Banks also see an added financial incentive in this shift, driving profit and economic growth following lowered operational costs and need for physical branches [7]. For consumers, these developments are generally equally complementary to the contemporary user's everyday needs, lending enhanced functionality, convenience, and efficiency to the banking experience [8]. Customers now remotely access and manage accounts and transactions, make investments, or take loans out at just a touch. These bridged temporal and spatial limitations for financial activity are hugely useful, particularly in its potential to improve quality of life and address financial exclusion in rural users [9, 10]. Where banking services may have once been highly inconvenient or inaccessible, previously underserved or less urbanised populations may now easily access the same features and service quality as networks continue to develop. In maintaining their competitive edge, banks may strive for efficient development and effective designs—ideally informed by the consumer's perspective. The need for in-depth analysis of the drivers of consumer behaviour has directed studies of mobile banking towards themes such as building long-term relationships, brand loyalty, and more recently continuous trust [11, 12].

For this technology to thrive in the long-term, continuous interest and use is crucial. Though, despite the added utility noted above, potential risks including private information leaks, hacking, lack of control, and poor experiences may equally deter users from continued use of the application [13, 14]. Being physically unable to directly interact with the service beyond a phone screen, mobile banking interactions may be perceived as limited and insecure. This proves a challenge in fully retaining high trust levels, thought to effectively mitigate anxiety and perceived threat associated with these risks [15]. Insight on the features most optimal for trust may inform further design for user experience, maintaining mass usage, and informing brand loyalty [11, 16, 17].

1.1 Literature gaps

Continuous, or post-use, trust refers to trust developed past initial adoption, at which relative amounts of exposure and experience with the technology can be expected [18]. It is noted to be one of the key factors contributing to retention and forming continuous-use intentions (Li & Xue, 2021). Mobile banking research on trust is typically focused on the initial adoption stage [19], or on investigating behavioural, and more recently continuance usage intentions of the application [20-26].

Trust is a dynamic relationship, and can change throughout the duration of the interaction (Li & Xue, 2021). Clearly, at a later stage of market penetration, maintaining continuous, long-term trust proves increasingly relevant. Simply offering mobile banking services may begin to be insufficient in remaining competitive, making it imperative for banks to now actively seek early strategies for retaining their existing customer base after initial adoption [20]. Despite this, models directly testing continuous trust, especially in mobile banking, is scant despite being an increasingly key area of interest.

1.2 Study aims

In the present study, we attempt to propose a model of features informing continuous trust in mobile banking. Based on the above, identifying the antecedents of mobile banking customers' continued trust may aid banks in the development of informed, realistic strategies for strengthening customer interaction and experience [17]. As such, the present study draws from the extensive past literature, aiming to identify critical constructs and examine how they inform continuous trust by analysing survey data through structural equation modelling (SEM) in a sample of existing mobile banking users. As features of mobile banking stay relatively constant throughout interaction stages with mobile banking, we relate to constructs commonly referred to in mobile banking research, here framed in the context of continuous trust.

2 Conceptual Framework

The extant mobile banking literature has generally identified three distinct clusters of latent constructs that predict trust –mobile application related, organisation related, and customer related antecedents. This section briefly refers to trust in the post-use stage with reference to these perceptions. Guided by the following hypotheses, we further relate constructs to form two models proposed for validation.

2.1 Customers' continuous trust in post-use stage

Trustworthiness is defined in retailing literature as “the subjective belief with which organisational members collectively assess that a population of organisations will perform potential transactions according to their confident expectations, irrespective of their ability to fully monitor them” [27]. Due to temporal and spatial gaps in the mobile network, mobile banking generally involves larger risks as compared to offline banking settings [28]. Prior to initiating a transaction, customers may first need to build sufficient levels of trust towards the platform and its services. While online trust has been studied extensively [29-31], research specifically on trust of mobile banking is still argued to be lacking [32].

Trust is differentiated between initial and continuous trust (trust at a post-use stage) [28], modulated by differing antecedents in the existing literature. While both types of trust studies have identified common antecedents such as perceived security and privacy, information quality, organisation reputation, etc. [18, 32-35], these findings are often inconsistent, with some studies also having highlighted the significant influence of a customer's previous experience leading to post-use trust [17, 36]. The key difference between these two threads of investigation being the stage of the interaction at the time. These factors are categorised and discussed in the following sections.

2.2 Mobile banking app-related antecedents

Perceived ease of use (PEU): This concept is derived from the technology acceptance model (TAM), defined as “freedom from effort” spent while using, or learning to use a new technology [37]. Ease of use in mobile banking services might be influenced by the user friendliness of interface design, information presentation style, and the general ease of interaction with the application [38, 39]. Compared to online banking on computers or tablet devices, mobile phone screens are significantly smaller, greatly limiting the amount of information to be displayed. As such, users may at times find the application challenging to use or be lacking in some way due to inadequate design. We can expect easier-to-use systems to reduce transaction anxiety, and contribute towards greater trust building [40]. In mobile banking trust studies, the findings on the relationship between perceived ease of use and trust have not yet reached a consensus. While studies on both continuous trust [28] and initial trust [32] generally support a positive association with increased ease of use, some studies in South Africa [41] and Korea [42] have found this relationship to be insignificant. Thus, we similarly seek to test the following hypothesis:

H1: Customers' perceived ease of use positively influences their continuous trust in mobile banking.

Privacy assurance and security features (PASF): Privacy and security assurances have been considered vital in a customer's evaluation of trustworthiness [30, 43]. It specifically refers to any protective measures such as guarantees, contracts, regulations, or transaction procedures that might effectively assure the customer of their expected outcomes [40]. Mobile banking typically involves high-risk financial transactions, private credit card or bank account information. Users may choose to revert or disengage with the service due to a fear of perceived risks and harm. As such, these assurances become even more

critical in gaining customers' trust in the absence of any physical services. Studies have demonstrated this importance and strong link to trust [28, 44, 45]. Herein, the following hypothesis is added to the study:

H2: The privacy assurance and security features positively affect customers' continuous trust in mobile banking.

Information quality (IQ): According to Beldad, de Jong [30], information quality refers to the usefulness, completeness, and accuracy of the information provided to customers. It is argued that if irrelevant or misguided information were to be provided, customers' trust towards mobile banking service providers might be negatively affected [46]. This argument has been supported by findings from some of past research [46-48], though there have also been instances where no significant relationship between information quality and trust was observed [49]. As such, the following hypothesis was included for testing:

H3: Higher information quality positively affects customers' continuous trust in mobile banking.

2.3 Company-related antecedents

Organisation reputation (OR): Higher rated, or more reputable organisations generally garner a more positive or trustworthy relationship with customers [30, 50]. In online banking settings, organisation reputation can be assessed as the company's credibility in delivering services and reliably catering to its customers' interests [32, 38]. Maintaining a positive organisational reputation requires large amounts of resources and consistent reinforcement, and this image rapidly declines with just a few mishaps. Particularly as banking is such a high-risk activity, a bad reputation could be detrimental to the future dealings of a company. As such, customers might understandably tend to trust companies with better reputations where it can be assumed that risking reputational damage outweighs the potential gains of sacrificing their customers' interests [29]. The following hypothesis is hence proposed:

H4: Positive organisation reputation leads to higher trust from customers in mobile banking.

Customer support (CS): In online banking, customer support is generally delivered through technology-based channels such as call centres (including phone and email), chat bots, and integrated feedback functions within the app itself [51]. A key difference in the customer support experience in mobile banking as compared to traditional banking services is the absence of any face-to-face interactions with the service provider [52]. This lack of social presence may add to the perceived structural insecurity and lack of quality customer support. Especially as customers typically only seek customer support when faced with urgent, problematic circumstances, the expectations associated with each interaction are likely to be high. On the other hand, critical and timely support reflects good reliability [49], and thus facilitates positive experiences. This may strengthen a customer's trust, enabling continuous interaction with the mobile banking application based on this assurance [53]. As such, the following hypothesis is included:

H5: The perceived level of customer support positively influences continuous trust in mobile banking.

To date, past studies in mobile banking trust mostly focused on the direct effects of the above variables. However, it is reasonable to argue that in the absence of professional knowledge of the mobile banking app, a customer's perception of the app should also be influenced by how reputable these organisations have proven to be, and the degree of support they are offered with. A recent mobile banking trust study [54] explored the relationship between organisation reputation and perceived security level of an app. The current study attempts to extend this by testing how both organisation reputation, and customer support could influence each of the stated app-related variables: organisation reputation on perceived ease of use (H4a), privacy assurance and security features (H4b), and information quality (H4c); customer support on perceived ease of use (H5a), privacy assurance and security features (H5b), and information quality (H5c).

2.4 Customers-related antecedents

Propensity to trust (PTT): refers to a customers' inherent disposition to trust others prior to any knowledge or experience to inform judgement [55]. It is rooted in an individual's personality in terms of traits of openness to experience and risk taking [56]. This has particular implications on initial adoption of mobile banking as customers attempt to accept new and innovative wireless transaction services with unknown risks [30]. However, studies have revealed conflicting findings. Some have shown propensity to trust to be a significant antecedent to customers' trust [34, 57], while other studies have not shown support for the relationship [28, 32]. Furthermore, at a post-use stage, the effects of propensity to trust have not yet been commonly explored. To examine the potential influence of propensity to trust on continuous trust after the initial adoption stage, the following hypothesis is tested in the current study:

H6: Customers' propensity to trust positively influence their continuous trust in mobile banking.

Previous experience (PE) with mobile banking: A customer's experience can be defined as their cognitive and affective response before, during, and after interacting with the provided service [58]. In studies of initial trust, experience is typically inferred as exposure to other related technology [30]. In mobile banking settings, for example, it refers to a customers' general familiarity and use of mobile banking applications [32]. However, at this post-use stage, customers have already passed the initial adoption hurdle. Hence, we further developed the concept of previous experience to sufficiently capture subjective perceptions of mobile banking apps. We expect positive past experiences to contribute towards trust building, and negative experiences to be associated with lower trust [14].

In some continuous trust studies, previous experience can also be interpreted as perceived flow of service [36], previous knowledge [59], and mobile experience [60]. In each case, a positive relationship between previous experience and trust was established [35]. Hence, to examine the of previous experience on continuous trust, we proposed the following:

H7: Customers' previous experience positively influences their continuous trust in mobile banking.

Again, at a post-use stage, customers have since passed the initial adoption hurdle and demonstrate frequent exposure to mobile banking services. Their perception towards these apps and providers have likely been heavily influenced by past individual experiences. This has implications on our model predicting continuous trust. In addition to a direct antecedent to trust, we therefore further expect previous experience significantly influence other latent constructs including perceived ease of use (H7a), privacy assurances and security features (H7b), information quality (H7c), organisation reputation (H7d), and customer support (H7e). Though, as in the literature, we similarly maintain conceptualising propensity to trust as a stable personality trait directly related to continuous trust instead of a mediating factor.

2.5 Integrated model

The above-stated hypotheses postulate the seven identified latent constructs (perceived ease of use, privacy assurance and security features, information quality, organisation reputation, customer support, propensity to trust, and previous experience) as direct and indirect antecedents to trust. The full model proposed in Figure 1.

3 Methodology

3.1 Questionnaire design

Informed by the constructed model, we designed a questionnaire rated on a 7-point Likert scale (1-Strongly disagree, 3-Neutral, 7-Strongly agree) with well-validated items adapted from previous questionnaires (see Table 1). Table 1 details the items for each of the latent constructs. In addition, we further incorporated items regarding respondents' age and gender to account for the effects of user demographics.

Table 1
Items in each construct and their sources

Construct	Item	Source
Perceived Ease of Use (PEU)	<p>PEU1. Visual graphics of the mobile banking app are user friendly</p> <p>PEU2. The presentation style of the mobile banking app is easy to understand</p> <p>PEU3. This mobile banking app is easy to use</p> <p>PEU4. My interaction with this mobile banking app is clear and understandable</p>	<i>Koufaris and Hampton-Sosa [29]; Lee and Chung [38]</i>
Privacy Assurances and Security Features (PASF)	<p>PASF1. I would find this mobile banking app secure enough to conduct my banking transaction</p> <p>PASF2. I feel secure about the electronic transaction systems of the mobile banking app</p> <p>PASF3. I trust in the ability of an online bank to protect my privacy</p>	<i>Akturan and Tezcan [67]; Kaushik, Mohan [32]; Lee and Chung [38]</i>
Information Quality (IQ)	<p>IQ1. The mobile banking app provides accurate information</p> <p>IQ2. The mobile banking app provides complete information</p> <p>IQ3. The mobile banking app provides information easy to understand</p> <p>IQ4. The mobile banking app provides information sequentially and systematically</p> <p>IQ5. The mobile banking app provides detailed information about services offered by the bank</p>	<i>Lee and Chung [38]; Shareef, Baabdullah [68]; Trabelsi-Zoghلامي, Berraies [49]</i>
Organisation Reputation (OR)	<p>OR1. I think the mobile banking company is concerned with the present and future interests of users</p> <p>OR2. This company has a good reputation</p> <p>OR3. I trust this company to offer secure mobile banking</p>	<i>Lee and Chung [38]; Kim, Shin [57]; Koufaris and Hampton-Sosa [29]</i>

Construct	Item	Source
Customer support (CS)	CS1. When I contact this companies' customer service, I am offered proper explanations CS2. When I contact this companies' customer service, my calls are always answered promptly CS3. I am satisfied with the service I have received from this company CS4. This company's services meet my needs	<i>Lee and Chung [38]; Thakur [52]</i>
Continuous Trust (CT)	CT1. This mobile banking app is trustworthy CT2. I trust in the services the mobile banking app provides CT3. I trust in this mobile banking app as I would trust a normal bank CT4. I believe the mobile banking app would keep its promises and commitments	<i>Akturan and Tezcan [67]; Gu, Lee [42]; Hoehle, Huff [18], Lee and Chung [38];</i>
Propensity to Trust (PTT)	PTT1. I am cautious in using new technologies to do my work PTT2. If possible, it is better to avoid using new technologies for financial transactions	<i>Kaushik, Mohan [32]; Kim, Shin [57]; Zhou [34]</i>
Previous Experience (PE)	PE1. I have sufficient experience in using this mobile banking app PE2. I am satisfied with the service I have received from the mobile banking app PE3. Overall, I have been satisfied with the mobile banking app	<i>Kaushik, Mohan [32]; Lee and Chung [38]</i>

3.2 Survey administration and respondents' demographics

The survey study was approved by Institution Review Board (IRB reference number: IRB-2021-305) and carried out in accordance with relevant guidelines and regulations. The survey was administered online, where existing mobile banking users in China were invited to participate. The questionnaire was first designed in English, then translated to Chinese by native Chinese speakers, and administered as such. To avoid any bias introduced by the instrument, items for each construct were presented randomly. As the present study was concerned with continuous trust at a post-use stage, inclusion criteria required respondents to indicate sufficiently frequent use of mobile banking before being allowed to proceed. We collected a total of 557 responses. For which, informed consent was obtained from all respondents. To

preserve validity, any incomplete responses, or responses which indicated a lack of attention (flat-lined responses) were removed. After cleaning, a final sample of 450 responses were entered for further analysis.

Table 2 presents the respondents' demographic characteristics and their most frequently used banks. Slightly more male respondents (53.8%) were surveyed. The respondents' age ranged from 19 to 50 years, with the age group of 19–25 years accounting for 37.6% of the respondents. The age and gender distributions generally fit with, and are representative of the mobile banking user demographics in China [61].

Table 2
Respondents' Demographic Characteristics (n = 450)

Characteristics	Attributes	Frequency	Percentage (%)	Frequently used banks	Frequency	Percentage (%)
Gender	Female	208	46.2	CCB	92	20.4
	Male	242	53.8	ICBC	80	17.8
Age	19–25 years	169	37.6	BOC	76	16.9
		71	15.8	CMB	67	14.9
	26–30 years	93	20.7	ABOC	47	10.4
		65	14.4	BOCM	28	6.2
	36–40 years	52	11.6	PSBC	20	4.4
		Other banks	40	8.9		
41–50 years						

4 Findings

First, to evaluate the validity of the measurement items and goodness of fit, confirmatory factor analysis (CFA) was performed. After which, the structural models formed in the current study were tested and compared from the statistics derived.

4.1 Measurement model validation

Confirmatory analysis was conducted to evaluate model fits for each of the measurement items tested (see Table 3). The presented model indices in the following table indicated a good fit [62]. Furthermore, the computed composite reliability (CR) values were above 0.7, demonstrating the measurements to be reliable and appropriate [63]. The average variance extracted (AVE) values were above the stipulated threshold of 0.5 [64], indicating good convergent validity.

Table 3
Confirmatory factor analysis results (N = 450)

	Mean	Standard Deviation	Standardised factor loading	t-value	CR	AVE
PE1	3.90	1.09	0.82	***	0.89	0.72
PE2	3.98	0.85	0.87	14.16		
PE3	4.03	0.82	0.86	14.14		
PTT1	3.54	1.04	0.89	***	0.85	0.73
PTT2	2.84	1.10	0.82	19.68		
PEU1	3.83	0.87	0.83	***	0.89	0.66
PEU2	3.95	0.82	0.82	20.73		
PEU3	4.02	0.85	0.82	20.54		
PEU4	3.88	0.84	0.79	19.44		
PASF1	4.10	0.78	0.88	***	0.90	0.74
PASF2	4.06	0.85	0.83	22.24		
PASF3	4.15	0.77	0.87	24.25		
IQ1	4.09	0.81	0.78	***	0.90	0.64
IQ2	3.97	0.82	0.78	17.76		
IQ3	3.98	0.81	0.81	18.60		
IQ4	3.99	0.79	0.82	18.91		
IQ5	3.92	0.85	0.80	18.39		
OR1	3.92	0.87	0.76	***	0.80	0.57
OR2	4.23	0.76	0.78	16.62		
OR3	3.92	0.93	0.73	15.55		
CS1	3.95	0.84	0.78	***	0.87	0.62
CS2	3.96	0.85	0.74	16.61		

PE: Previous Experience, PEU: Perceived Ease of Use, PASF: Privacy Assurances and Security Features, IQ: Information Quality, OR: Organisation Reputation, CS: Customer Support, CT: Continuous Trust.

*** Denotes a constrained relationship to 1 for identification

Degree of freedom (df) = $(i^2 + i)/2 - j$, for i equals the number of manifest variables and j equals the number of free parameters

	Mean	Standard Deviation	Standardised factor loading	t-value	CR	AVE
CS3	4.10	0.80	0.83	19.06		
CS4	4.12	0.78	0.79	18.08		
CT1	4.21	0.74	0.90	***	0.91	0.71
CT2	4.19	0.77	0.88	27.07		
CT3	4.08	0.86	0.70	17.96		
CT4	4.16	0.76	0.87	26.34		
Model fit indices: $\chi^2 = 666.77$; $df = 322$; $\chi^2/df = 2.07$; IFI = 0.96; TLI = 0.96; CFI = 0.96; RMSEA = 0.05						
PE: Previous Experience, PEU: Perceived Ease of Use, PASF: Privacy Assurances and Security Features, IQ: Information Quality, OR: Organisation Reputation, CS: Customer Support, CT: Continuous Trust.						
*** Donates a constrained relationship to 1 for identification						
Degree of freedom (df) = $(i^2 + i)/2 - j$, for i equals the number of manifest variables and j equals the number of free parameters						

Comparisons between AVE values and squared correlations are presented as in Table 4. As AVE values were higher than the squared correlation values, discriminant validity was supported in the current dataset [63].

Table 4
AVE, construct correlation and squared correlation

Factor	PE	PTT	PEU	PASF	IQ	OR	CS	CT
PE	0.72 ¹	0.03 ³	0.18	0.10	0.10	0.11	0.11	0.08
PTT	0.17 ²	0.72	0.04	0.03	0.02	0.03	0.03	0.02
PEU	0.43	0.21	0.66	0.11	0.15	0.11	0.13	0.10
PASF	0.31	0.17	0.33	0.74	0.11	0.14	0.12	0.13
IQ	0.32	0.15	0.39	0.33	0.64	0.12	0.12	0.10
OR	0.33	0.17	0.33	0.37	0.35	0.57	0.14	0.14
CS	0.33	0.16	0.36	0.34	0.35	0.37	0.62	0.14
CT	0.28	0.14	0.32	0.36	0.32	0.38	0.37	0.71
PE: Previous Experience, PEU: Perceived Ease of Use, PASF: Privacy Assurances and Security Features, IQ: Information Quality, OR: Organisation Reputation, CS: Customer Support, CT: Continuous Trust.								
¹ Average variance extracted (AVE) values are along the main diagonal								
² Correlations between constructs are below the main diagonal								
³ Squared correlations between constructs are above the main diagonal								

4.2 Pathway analysis

Structural pathway analysis was then conducted to test the effectiveness of the proposed full model. As shown in Table 5, the model fit indices indicate good fit for the proposed full model [62]. Among the hypotheses that directly test continuous trust (H1-7), H3 (information quality – continuous trust) was rejected; direct influences from customer-related antecedents (H6: previous experience – continuous trust, and H7: propensity to trust – continuous trust) to continuous trust were not supported. However, H4 (organisation reputation – continuous trust) and H5 (customer support – continuous trust) were supported by the model, indicating that effects from organisation reputation and customer support could also be mediated by privacy assurance and security features, as well as information quality. It should also be noted that though previous experience was not a direct predictor of continuous trust, the supported hypotheses H7a, and H7c-e indicated the influence of previous experience on continuous trust to be moderated by several other factors of interest (e.g., perceived ease of use, organisation reputation, and customer support).

Table 5
Pathway analysis of full model

Full model				
Hypothesis	Path	Std Coeff	P	Results
H1	PEU -> CT	0.203	0.042	Supported
H2	PASF -> CT	0.173	0.017	Supported
H3	IQ -> CT	-0.006	0.951	Rejected*
H4	OR -> CT	0.578	< 0.001	Supported
H5	CS -> CT	0.595	< 0.001	Supported
H6	PTT -> CT	-0.070	0.099	Rejected*
H7	PE -> CT	-0.085	0.121	Rejected*
H4a	OR -> PEU	0.100	0.209	Rejected*
H4b	OR -> PASF	0.579	< 0.001	Supported
H4c	OR -> IQ	0.307	< 0.001	Supported
H5a	CS -> PEU	0.023	0.240	Rejected*
H5b	CS -> PASF	0.259	0.001	Supported
H5c	CS -> IQ	0.283	< 0.001	Supported
H7a	PE -> PEU	0.918	< 0.001	Supported
H7b	PE -> PASF	0.049	0.681	Rejected*
H7c	PE -> IQ	0.380	< 0.001	Supported
H7d	PE -> OR	0.824	< 0.001	Supported
H7e	PE -> CS	0.828	< 0.001	Supported
Explanatory power: $R^2_{CT} = 0.823$				
Model fit indices: $\chi^2 = 847.666$; $df = 332$; $\chi^2/df = 2.55$; IFI = 0.943; TLI = 0.934; CFI = 0.942; RMSEA = 0.059				
PE: Previous Experience, PEU: Perceived Ease of Use, PASF: Privacy Assurances and Security Features, IQ: Information Quality, OR: Organisation Reputation, CS: Customer Support, CT: Continuous Trust.				
*Hypothesis rejected on the confident interval: $\alpha = 0.05$				

4.3 Reduced model

Considering not all hypotheses were supported in the full model, variables and links that did not yield significance in predicting continuous trust were removed to obtain a reduced model. The reduced model was then compared with the full model in their goodness of fit, and explanatory power regarding continuous trust, and parsimony fit indices.

The comparison of two models typically involves the following three steps: 1. The model fit indices of each model are compared against the acceptance criteria; 2. If the survey data adequately fits both models, the explanatory power (in terms of R^2) of each model is then compared, with that of the greater value accepted [65, 66]; and 3. If both models are equivalent in goodness of fit and explanatory power, the more parsimonious model would be adopted.

The comparison results are listed in Table 6 below. In terms of model fit indices, both models demonstrated acceptable levels of fit to the collected survey data, fulfilling criteria including $CFI > 0.90$, $TLI > 0.90$, and $RMSEA < 0.07$. As the differences in model fit indices between the two models are negligible, their explanatory power (R^2) regarding continuous trust is compared. It is noted that with reduced variables and links, 81.8% of the variation in continuous trust was explained by the model, with a reduction of only 0.5% as compared to the full model. The major difference between the two models is in their parsimony fit indices (AIC, Akaike Information Criterion). A considerable amount of reduction in AIC value of the reduced model (597.254 as compared to 995.666 in the full model) indicates that the reduced model is more parsimonious. The reduced model was hence selected as the more optimal model.

Table 6
Model comparison

	χ^2	<i>df</i>	χ^2/df	<i>IFI</i>	<i>TLI</i>	<i>CFI</i>	<i>RMSEA</i>	<i>AIC</i>	R^2_{CT}
Full Model	847.666	332	2.553	0.943	0.934	0.942	0.059	995.666	0.823
Reduced Model	493.254	179	2.756	0.955	0.947	0.954	0.063	597.254	0.818

Results of the reduced model from pathway analysis are presented in Fig. 2. All hypotheses were supported with a confidence interval of $\alpha = 0.05$. These observations were similar to the full model. The personality trait of propensity to trust did not reflect customers' continuous trust. Similarly, information quality was not a strong predictor of trust in the post-use stage. Instead, other app-related variables (perceived ease of use, and privacy assurance and security features) and company-related variables (organisation reputation, and customer support) were validated as direct antecedents to continuous trust. Some indirect effects were also observed in the model. Organisation reputation and customer support indirectly influenced continuous trust as mediated by privacy assurance and security features. Further, previous experience did not directly inform continuous trust here. Its effects were mediated by perceived ease of use, organisation reputation, and customer support.

5 Discussion And Conclusion

5.1 Supported hypotheses

A framework to predict customers' continuous trust in mobile banking at post-use stage

In an attempt to develop an indicative model of the key factors in predicting a customer's continuous trust, critical constructs were identified from the existing mobile banking and continuous trust literature. Hypothesised factors influencing continuous trust were proposed and integrated to form a unified model for empirical testing. The current study shows its novelty by integrating the potential influences of customers' perception of the company with their continuous trust of the app in our model. Furthermore, considering the potential influences of a customer's previous experience on the perception of mobile banking applications and associated organisations, effects from previous experience as mediated by other factors were also incorporated in this model. We found the overall indices of good fit for the full model and its reduced form to be generally robust. In both models, the majority of the variation in continuous trust could be well explained ($R^2_{CT}=0.823$ for the full model, and $R^2_{CT}=0.818$ for the reduced model). As the reduced model is more parsimonious, it is accepted as optimal for predicting customers' continuous trust based on the constructs tested in the present study. This implies that while propensity to trust may not influence continuous trust in the post-use stage, an individual's previous experience shaped factors such as perceived ease of use, information quality, organisation reputation, and customer support – which then informed users' continuous trust levels. Following, organisation reputation and customer support were found to have the strongest effects on strengthening customers' continuous trust. The two company-related factors could also influence how customers view the app's privacy assurances and security features, and are important in predicting continuous trust.

Company-related perception influencing app-related perception

The current trust study adds novelty in understanding the relationship between organisation reputation and customer support on customers' perception of the mobile banking app. The full model revealed both organisation reputation, and customer support to significantly influence customers' evaluations of both privacy assurance and security features, and information quality in mobile banking apps. This implicates that high reputation and strong support from the banks are not only direct signals of trustworthiness, but also indirect indicators of their apps' reliability and information quality as perceived by customers.

Customers' previous experience affecting their perception towards mobile banking apps and service providing companies

Contributing new knowledge to the existing mobile banking trust studies, the current study proposed that in modelling customers' trust at a post-use stage, their perception towards the apps (perceived ease of use, privacy assurance and security features, and information quality) and providing companies

(organisation reputation, and customer support) would be readily influenced by their previous exposure to these services. Five out of the six proposed hypotheses (with the exception of previous experience – privacy assurance and security features) were supported through the validation of the reduced model with empirical data. This suggests past experiences with mobile banking to significantly moderate present perceptions of mobile banking features, alluding to a reciprocal relationship. It is suggested that banks thus pay close attention to, and even consider strengthening communicative relationships with their customers. This simultaneously allows for gaining first-hand, reliable insight on their individual experiences, whilst providing enhanced quality service.

The absence of influences from propensity to trust, and information quality

It is worth noting some more contentious findings of the present study. The influence of customers' propensity to trust on continuous trust was not observed, though this has been supported in some studies of initial mobile banking trust [28, 32]. *Propensity to trust indicates the degree to which trust might be assigned to a technology by customers given little prior experience or knowledge. This highlights the two distinct time points and stages of consumer trust, with a potential explanation for this difference being that at a post-use stage, customers have become relatively familiar with mobile banking through continuous usage, essentially nullifying the effects of an individual's propensity to trust. On the other hand, information quality was found to have no significant influence on customers' trust here. A recent study conducted in Tunisia found similar results, arguing customers tended to prioritise, and were primarily concerned with security and privacy features over information quality and aesthetics [49].*

5.2 Theoretical Contribution

The present study outlined factors influencing continuous trust in mobile banking, having highlighted constructs most relevant in predicting this relationship in the resulting reduced model. In doing so, we have attempted to contribute towards the scant literature explicitly integrating concepts of continuous trust in mobile banking, particularly after initial adoption. By adapting similar constructs of interest in initial mobile banking trust studies, we may invite comparisons between these two stages of consumer trust – before and after initial adoption. The presently derived model serves as a point of theoretical explanation for the complex, interrelated relationships of various facets of consumer trust and perception of mobile banking applications. Future research may consider developments such as investigating continuous trust across various time points of use, and perhaps the inclusion of other constructs of interest.

5.3 Practical implications

Findings from the current study may be informative to banks with regards to developing effective strategies for the long-term maintenance of existing customers' trust in mobile banking apps, and thus customer loyalty. We further add to the discussion of designing user-friendly interfaces that might support functionality and user retention. The most important aspects (perceived ease of use, privacy assurance and security features, organisation reputation, and customer support) influencing customers' trust were successfully identified. In practice, customers generally appear to show more concern in the ability of the app to protect their personal information. This might only expect to be more critical in mobile banking apps, which are directly linked to sensitive financial information. Enhancing this protection of customers' information and developing secure transaction processes are likely to reinforce trust and loyalty in mobile banking [16]. Maintaining corporate image is also critical in retaining this trust, as highly regarded banks are perceived as more likely to treat their customers fairly and cater to their interests. It expects to build confidence in the use of these services. Furthermore, ensuring timely and reliable customer support is crucial. Responsive, timely, and helpful support from banks is critical for customers facing issues in the absence of physical interactions. Their experience with such online customer support might either greatly enhance, or completely damage their trust in mobile banking, with effects potentially extending to the reputation of banks themselves.

5.4 Availability of Data and Materials

The datasets used and/or analysed during the current study available from the corresponding author on reasonable request.

Declarations

Acknowledgements

This research is supported by the Joint NTU-WeBank Research Centre on Fintech (Award No: NWJ-2020-009), Nanyang Technological University, Singapore. The study was approved by Institution Review Board (IRB reference number: IRB-2021-305).

Author contributions

C.M.: Design of the work, analysis, interpretation of data, and having drafted the work.

S.S.Y.A.: Design of the work, and having drafted the work.

Y.H.: Conception and design of the work.

Z.Q.: Analysis, and interpretation of data.

S.J., S.W., and L.X.: Acquisition, and preliminary analysis of data.

X.H.: Conception and design of the work, interpretation of data, and having substantively revised the work.

Data availability

Data not available.

Conflict of interest

None.

References

1. Statista. *Number of smartphone users from 2016 to 2021*. 2021 [cited 2021 11-Oct-2021]; Available from: <https://www.statista.com/statistics/330695/number-of-smartphone-users-worldwide/>.
2. Ahmad, W.S.H.M.W., et al., *5G Technology: Towards dynamic spectrum sharing using cognitive radio networks*. IEEE Access, 2020. **8**: p. 14460–14488.
3. Painuly, S., et al. *Advance applications and future challenges of 5G IoT*. in *2020 3rd International Conference on Intelligent Sustainable Systems (ICISS)*. 2020.
4. Souiden, N., R. Ladhari, and N.-E. Chiadmi, *New trends in retailing and services*. Journal of Retailing and Consumer Services, 2019. **50**: p. 286–288.
5. Laukkanen, T., *Mobile banking*. International Journal of Bank Marketing, 2017. **35**(7): p. 1042–1043.
6. Souiden, N., R. Ladhari, and W. Chaouali, *Mobile banking adoption: a systematic review*. International Journal of Bank Marketing, 2021. **39**(2): p. 214–241.
7. Liu, Z., Q. Min, and S. Ji. *An empirical study on mobile banking adoption: The role of trust*. in *2009 Second International Symposium on Electronic Commerce and Security*. 2009.
8. Ström, R., M. Vendel, and J. Bredican, *Mobile marketing: A literature review on its value for consumers and retailers*. Journal of Retailing and Consumer Services, 2014. **21**(6): p. 1001–1012.
9. Baptista, G. and T. Oliveira, *Understanding mobile banking: The unified theory of acceptance and use of technology combined with cultural moderators*. Computers in Human Behavior, 2015. **50**: p. 418–430.
10. Shaikh, A.A., H. Karjaluoto, and N.B. Chinje, *Continuous mobile banking usage and relationship commitment – A multi-country assessment*. Journal of Financial Services Marketing, 2015. **20**(3): p. 208–219.
11. Kosiba, J.P.B., et al., *Examining customer engagement and brand loyalty in retail banking*. International Journal of Retail & Distribution Management, 2018. **46**(8): p. 764–779.
12. Hoehle, H., E. Scornavacca, and S. Huff, *Three decades of research on consumer adoption and utilization of electronic banking channels: A literature analysis*. Decision Support Systems, 2012. **54**(1): p. 122–132.

13. Zhou, T., *Understanding users' initial trust in mobile banking: An elaboration likelihood perspective*. Computers in Human Behavior, 2012. **28**(4): p. 1518–1525.
14. Wessels, L. and J. Drennan, *An investigation of consumer acceptance of M-banking*. International Journal of Bank Marketing, 2010. **28**(7): p. 547–568.
15. Hernández-Ortega, B., *The role of post-use trust in the acceptance of a technology: Drivers and consequences*. Technovation, 2011. **31**(10): p. 523–538.
16. Zhou, Q., et al., *A study on factors affecting service quality and loyalty intention in mobile banking*. Journal of Retailing and Consumer Services, 2021. **60**: p. 102424.
17. Jamshidi, D., et al., *Mobile banking behavior and flow experience*. International Journal of Social Economics, 2018. **45**(1): p. 57–81.
18. Hoehle, H., S. Huff, and S. Goode, *The role of continuous trust in information systems continuance*. Journal of Computer Information Systems, 2012. **52**(4): p. 1–9.
19. Chong, A.Y.-L., F.T.S. Chan, and K.-B. Ooi, *Predicting consumer decisions to adopt mobile commerce: Cross country empirical examination between China and Malaysia*. Decision Support Systems, 2012. **53**(1): p. 34–43.
20. Al-Ghazali, B.M., et al., *Antecedents of continuous usage intention of mobile banking services from the perspective of DeLone and McLean Model of IS success*. International Journal of Economics and Financial Issues, 2015. **5**(1S).
21. Sharma, S.K. and M. Sharma, *Examining the role of trust and quality dimensions in the actual usage of mobile banking services: An empirical investigation*. International Journal of Information Management, 2019. **44**: p. 65–75.
22. Malaquias, R.F. and Y. Hwang, *An empirical study on trust in mobile banking: A developing country perspective*. Computers in Human Behavior, 2016. **54**: p. 453–461.
23. Ghobakhloo, M. and M. Fathi, *Modeling the success of application-based mobile banking*. Economies, 2019. **7**(4).
24. Adapa, S. and S.K. Roy, *Consumers' post-adoption behaviour towards Internet banking: Empirical evidence from Australia*. Behaviour & Information Technology, 2017. **36**(9): p. 970–983.
25. Luo, X., et al., *Examining multi-dimensional trust and multi-faceted risk in initial acceptance of emerging technologies: An empirical study of mobile banking services*. Decision Support Systems, 2010. **49**(2): p. 222–234.
26. Kala Kamdjoug, J.R., et al., *Determining factors and impacts of the intention to adopt mobile banking app in Cameroon: Case of SARA by afriland First Bank*. Journal of Retailing and Consumer Services, 2021. **61**: p. 102509.
27. Chellappa, R.K. and P.A. Pavlou, *Perceived information security, financial liability and consumer trust in electronic commerce transactions*. Logistics Information Management, 2002. **15**(5/6): p. 358–368.

28. Zhou, T., *Examining mobile banking user adoption from the perspectives of trust and flow experience*. Information Technology and Management, 2012. **13**(1): p. 27–37.
29. Koufaris, M. and W. Hampton-Sosa, *The development of initial trust in an online company by new customers*. Information & Management, 2004. **41**(3): p. 377–397.
30. Beldad, A., M. de Jong, and M. Steehouder, *How shall I trust the faceless and the intangible? A literature review on the antecedents of online trust*. Computers in Human Behavior, 2010. **26**(5): p. 857–869.
31. Kim, Y. and R.A. Peterson, *A meta-analysis of online trust relationships in E-commerce*. Journal of Interactive Marketing, 2017. **38**: p. 44–54.
32. Kaushik, A.K., G. Mohan, and V. Kumar, *Examining the antecedents and consequences of customers' trust toward mobile retail apps in India*. Journal of Internet Commerce, 2020. **19**(1): p. 1–31.
33. Olaleye, S.A., et al. *Effect of gratification, utilitarian, and trust elements on the use of retail mobile banking app in Africa: A comparative study*. in 2019 IEEE AFRICON. 2019.
34. Zhou, T., *An empirical examination of initial trust in mobile banking*. Internet Research, 2011. **21**(5): p. 527–540.
35. Sun, B., et al., *Research on initial trust model of mobile banking users*. Journal of Risk Analysis and Crisis Response, 2017. **7**(1): p. 13–20.
36. Rajaobelina, L., et al., *Not all elderly are the same: Fostering trust through mobile banking service experience*. International Journal of Bank Marketing, 2021. **39**(1): p. 85–106.
37. Davis, F.D., *Perceived usefulness, perceived ease of use, and user acceptance of information technology*. MIS Quarterly, 1989. **13**(3): p. 319–340.
38. Lee, K.C. and N. Chung, *Understanding factors affecting trust in and satisfaction with mobile banking in Korea: A modified DeLone and McLean's model perspective*. Interacting with Computers, 2009. **21**(5–6): p. 385–392.
39. Jebarajakirthy, C. and A. Shankar, *Impact of online convenience on mobile banking adoption intention: A moderated mediation approach*. Journal of Retailing and Consumer Services, 2021. **58**: p. 102323.
40. Chien, S.-H., Y.-H. Chen, and C.-Y. Hsu, *Exploring the impact of trust and relational embeddedness in e-marketplaces: An empirical study in Taiwan*. Industrial Marketing Management, 2012. **41**(3): p. 460–468.
41. Van Deventer, M., *Antecedents of trust in mobile banking amongst Generation Y students in South Africa*. Acta Universitatis Danubius. (Economica), 2019. **15**(3): p. 123–141.
42. Gu, J.-C., S.-C. Lee, and Y.-H. Suh, *Determinants of behavioral intention to mobile banking*. Expert Systems with Applications, 2009. **36**(9): p. 11605–11616.
43. Sharma, S.K., et al., *Mobile wallet inhibitors: Developing a comprehensive theory using an integrated model*. Journal of Retailing and Consumer Services, 2018. **45**: p. 52–63.

44. Kumar, V., U. Kumar, and M.A. Shareef, *Mobile banking: A tradeoff between mobile technology and service for consumer behavioural intentions*. *Transnational Corporations Review*, 2017. **9**(4): p. 319–330.
45. Singh, S. and R.K. Srivastava, *Predicting the intention to use mobile banking in India*. *International Journal of Bank Marketing*, 2018. **36**(2): p. 357–378.
46. Zhou, T., *An empirical examination of continuance intention of mobile payment services*. *Decision Support Systems*, 2013. **54**(2): p. 1085–1091.
47. Berraies, S., R. Chtioui, and K.B. Yahia, *Functional characteristics of banking websites and customer loyalty: the mediating role of online trust*. *Journal of Applied Business Research (JABR)*, 2015. **31**(3): p. 911–924.
48. Geebren, A., A. Jabbar, and M. Luo, *Examining the role of consumer satisfaction within mobile ecosystems: Evidence from mobile banking services*. *Computers in Human Behavior*, 2021. **114**: p. 106584.
49. Trabelsi-Zoghalmi, A., S. Berraies, and K. Ben Yahia, *Service quality in a mobile-banking-applications context: do users' age and gender matter?* *Total Quality Management & Business Excellence*, 2020. **31**(15–16): p. 1639–1668.
50. Özkan, P., et al., *The effect of service quality and customer satisfaction on customer loyalty*. *International Journal of Bank Marketing*, 2020. **38**(2): p. 384–405.
51. Ganguli, S. and S.K. Roy, *Generic technology-based service quality dimensions in banking*. *International Journal of Bank Marketing*, 2011. **29**(2): p. 168–189.
52. Thakur, R., *What keeps mobile banking customers loyal?* *International Journal of Bank Marketing*, 2014. **32**(7): p. 628–646.
53. Johannes, V.D., I. Indarini, and S. Margaretha. *Usability, customer satisfaction, service, and trust towards mobile banking user loyalty*. in *Proceeding 15th International Symposium on Management (INSYMA 2018)*. 2018. Chongburi, Thailand: Atlantis Press.
54. Garrouch, K., *Does the reputation of the provider matter? A model explaining the continuance intention of mobile wallet applications*. *Journal of Decision Systems*, 2021. **30**(2–3): p. 150–171.
55. Gill, H., et al., *Antecedents of trust: Establishing a boundary condition for the relation between propensity to trust and intention to trust*. *Journal of Business and Psychology*, 2005. **19**(3): p. 287–302.
56. Freitag, M. and P.C. Bauer, *Personality traits and the propensity to trust friends and strangers*. *The Social Science Journal*, 2016. **53**(4): p. 467–476.
57. Kim, G., B. Shin, and H.G. Lee, *Understanding dynamics between initial trust and usage intentions of mobile banking*. *Information Systems Journal*, 2009. **19**(3): p. 283–311.
58. Grewal, D., M. Levy, and V. Kumar, *Customer Experience Management in Retailing: An Organizing Framework*. *Journal of Retailing*, 2009. **85**(1): p. 1–14.

59. Yu, C.S., *Antecedents and consequences of trust in using mobile banking*. MIS REVIEW: An International Journal, 2015. **20**(2): p. 27–56.
60. Rajaobelina, L., et al., *Towards a better understanding of mobile banking: The impact of customer experience on trust and commitment*. Journal of Financial Services Marketing, 2018. **23**(3–4): p. 141–152.
61. Wang, S. and I. Petrounias. *Big data analysis on demographic characteristics of Chinese mobile banking users*. in 2017 IEEE 19th Conference on Business Informatics (CBI). 2017.
62. Hu, L.t. and P.M. Bentler, *Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives*. Structural Equation Modeling: A Multidisciplinary Journal, 1999. **6**(1): p. 1–55.
63. Hair, J.F., et al., *Multivariate Data Analysis*. 2013: Pearson Education Limited.
64. Hair, J.F., et al., *Multivariate data analysis*. Vol. 5. 1998: Prentice hall Upper Saddle River, NJ.
65. Rust, R.T., C. Lee, and E. Valente, *Comparing covariance structure models: A general methodology*. International Journal of Research in Marketing, 1995. **12**(4): p. 279–291.
66. Huh, H.J., T. Kim, and R. Law, *A comparison of competing theoretical models for understanding acceptance behavior of information systems in upscale hotels*. International Journal of Hospitality Management, 2009. **28**(1): p. 121–134.
67. Akturan, U. and N. Tezcan, *Mobile banking adoption of the youth market*. Marketing Intelligence & Planning, 2012. **30**(4): p. 444–459.
68. Shareef, M.A., et al., *Consumer adoption of mobile banking services: An empirical examination of factors according to adoption stages*. Journal of Retailing and Consumer Services, 2018. **43**: p. 54–67.

Figures

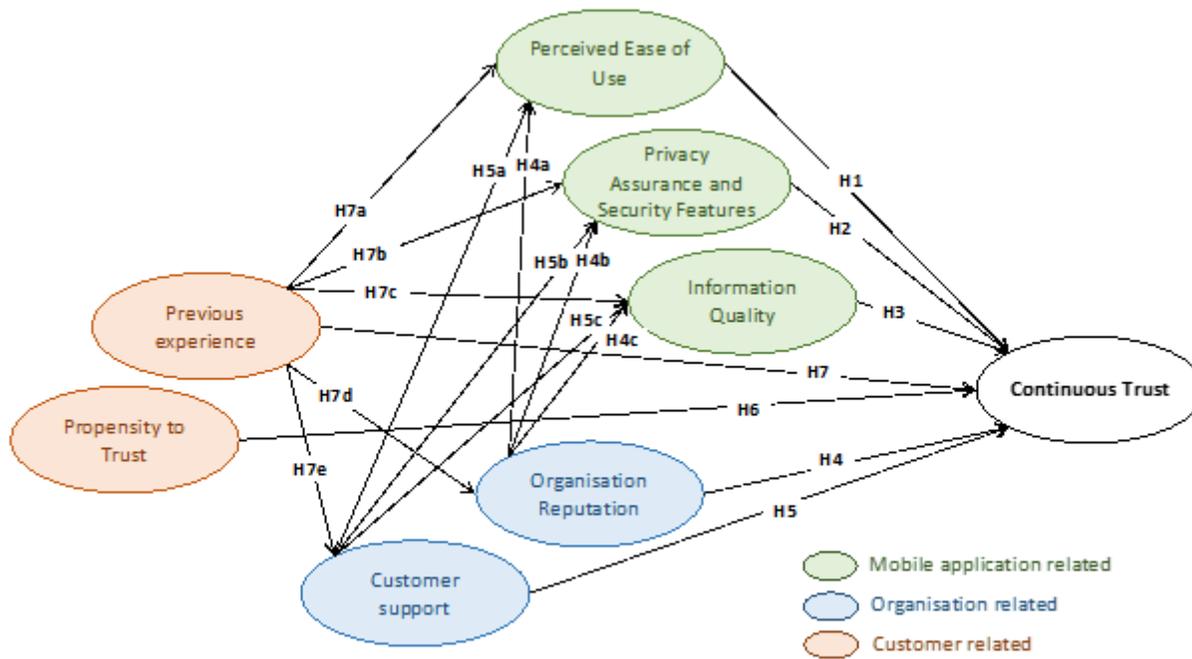
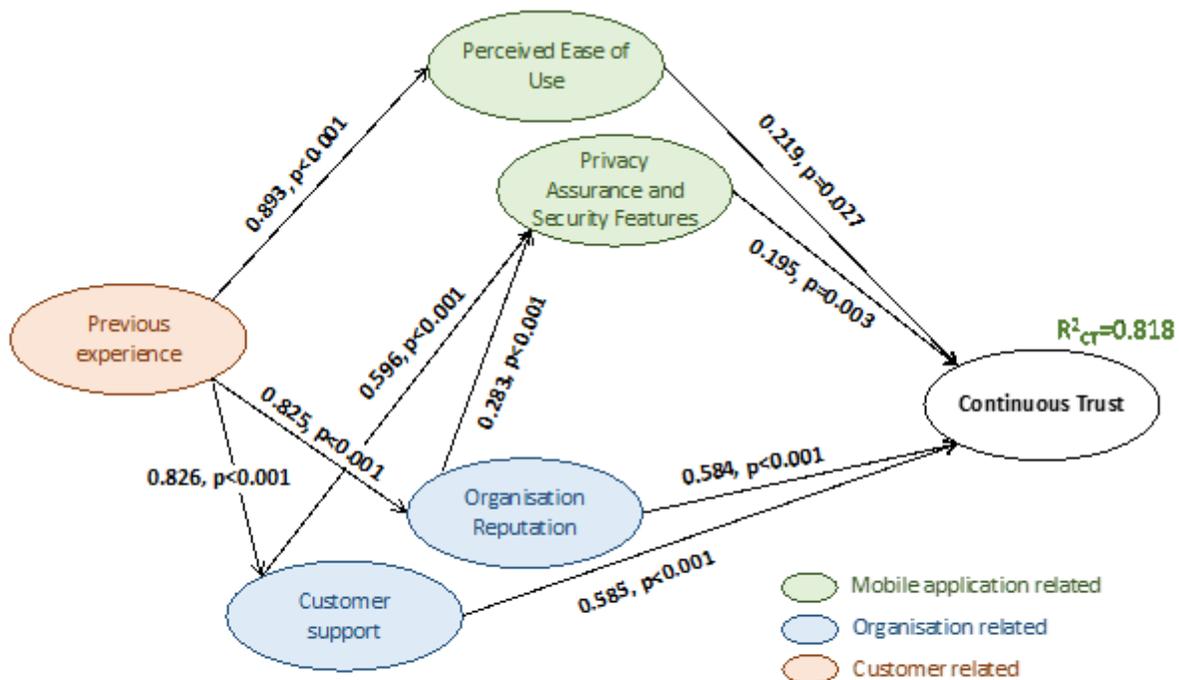


Figure 1

Full model



Explanatory power: $R^2_{CT} = 0.818$

Model fit indices: $\chi^2 = 493.254$; $df = 179$; $\chi^2/df = 2.76$; IFI = 0.955; TLI = 0.947; CFI = 0.954; RMSEA = 0.063

Figure 2

