International Journal of Soft Computing 12 (3): 164-177, 2017
ISSN: 1816-9503

Integration of Innovation Diffusion Theory (IDT) and Technology Acceptance Model (TAM) to Understand Mobile Banking Acceptance in Yemen: The Moderating Effect of Income

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Abstract: The combination of wireless technology and mobile devices through wireless infrastructure has reshaped the delivery and both the use and delivery of financial services as mobile banking rapidly spreads worldwide. The purpose of this study is to test the external critical success factors that impact the intention to use mobile banking services in Yemen via an extended model of TAM (Technology Acceptance Model). Evaluation of the proposed model was done through a survey of 482 Yemeni individuals who are non-users of mobile banking services. Structural Equation Modelling (SEM) via AMOS was utilised to determine the relative importance of associations and interactions between the factors tested. As evidenced by the goodness of fit of the model to the data, the proposed research model explained 80% of the variance in intention to use mobile banking services. The multivariate analysis revealed that trialability and compatibility have a significant positive effect on Perceived Usefulness (PU) and Perceived Ease of Use (PEOU). Furthermore, PEOU and PU both have a positive important influence on the behavioural intention to use mobile banking services in Yemen. The moderating effect of income was also tested between perceived usefulness and perceived ease of use and intention and it was found that income only moderated the relationship between perceived ease of use and intention to use mobile banking. The results of the current study have the potential to give further insights into mobile banking strategies.

Key words: Mobile banking, Yemen, technology acceptance model, innovation diffusion theory, compatibility, trialability, observability

INTRODUCTION

Technological advancements have led financial services providers to look for new channels to deliver banking services to their clients. The very nature of buying and selling of these services have changed and the use of mobile devices is one the banking industry's newest channels of service delivery. This evolution is moving clients from traditional service encounters to technology-based self-service, something which is beneficial to both bank and client as it decreases transaction cost and increases convenience (Wessels and Drennan, 2010). Mobile banking is achieving a fast, seamless, anytime and anywhere banking. Although, most of the Yemeni banks are providing mobile banking services, the adoption rate among their clients is still well behind other Arab countries. Low usage will lead to low performance, low productivity and less return on investment (Goodhue and Thompson, 1995; Norzaidi *et al*., 2007). Considering the huge investment banks are making into system development, it is crucial they ensure their clients use mobile banking. Because, there is a limited understanding of the factors influencing Yemeni bank's clients to accept mobile banking, an understanding of how individual differences and customer perceptions influence the adoption of mobile banking services will assist banks in creating solutions and strategic plans to attract their customers to use the service. Very little research has been undertaken in Yemen on factors influencing client behavioural intentions and the adoption of mobile banking and thus, there is a need for a study of this nature.

Many theories and model has been used to study acceptance and adoption of IS applications and among the most widely accepted approaches are the Technology Acceptance Model (TAM) of Davis (1989), Davis *et al*.,

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(1989) and the Innovation Diffusion Theory (IDT) of Rogers (2003). Many studies has used both approaches in different contexts and applications (Al-Ajam and Nor, 2013; Giovanis *et al*., 2012; Hsu and Lin, 2015; Liu *et al*., 2005; Oliveira and Martins, 2011; Zhong *et al*., 2013). The core constructs of TAM are perceived usefulness and perceived ease of use. Rogers (2003) has suggested five constructs, two of which (relative advantages and complexity) are similar to the core constructs of TAM (perceived ease use and perceived usefulness) and considered to have a complementary relationship (Moore and Benbasat, 1991) plus three (compatibility, trialability and observability) that provoke the diffusion of innovation. According to Rogers (2003), if an innovation has these five perceived characteristics it is more likely to succeed and be adopted. In this study, TAM is employed as the underpinning theory. However, one of its weaknesses is that it does not cover all aspects that could affect individual behavioural intention and actual behavior in IS adoption. Davis (1989) and Davis *et al*., (1989) suggest to examine the effect of external variables on the main construct of TAM in the original model. As TAM focuses only on PU and PEOU (Al-Qeisi, 2009; Davis, 1989; Taylor and Todd, 1995b) and neglects other factors for assessing the barriers to using an information system device it is unlikely to accurately reflect the adoption of mobile banking (Luarn and Lin, 2005). However, in this study, for the acceptance and adoption of mobile banking, other relevant factors besides PU and PEOU will be considered in order to derive a more powerful model to explain mobile banking acceptance in Yemen. A very promising approach which has not been used in the context of mobile banking is the combination of TAM with IDT.

Limited empirical researches have been carried out in developing countries, especially in Middle East (Al-Qeisi, 2009) but many studies have restated calls for examining the factors that predict intention behaviour to adopt mobile phone banking (Liu *et al*., 2008; Venkatesh *et al*., 2003). This study, therefore, integrates TAM with IDT and examines the impact of external variables on TAM and therefore on the behavioural intention to use mobile banking services in Yemen. This study attempts to achieve the following research objectives:

- To examine the effect of compatibility on perceived usefulness
- To examine the effect of compatibility on perceived ease of use
- To examine the effect of trialability on perceived usefulness
- To examine the effect of trialability on perceived ease of use
- To examine the effect of observability on perceived usefulness
- To examine the effect of Observability on perceived ease of use
- To examine the effect of perceived usefulness on the intention to use mobile banking services
- To examine the effect of perceived ease of use on perceived usefulness
- To examine the effect of perceived ease of use on intention to use mobile banking services
- To examine the moderating effect of income between perceived usefulness and intention
- To examine the moderating effect of income between perceived ease of use and intention

Literature review

Compatibility, perceived usefulness and perceived ease of use: Compatibility is one of the significant factors to determine the attitude of clients toward e-banking services and their adoption (Wu and Wang, 2005). It is considered a key determining factor of innovation diffusion as well (Rogers, 2003). Kleijnen *et al*. (2004) and Wu and Wang (2005) defined compatibility as 'the degree to which mobile banking services are in line with consumer lifestyle and current needs. Studies reveal that more than two-thirds of financial transaction services designed to meet the needs of clients fail due to non-ubiquity in traditional channels which is overcome by a wireless and mobile channel (Hourahine and Howard, 2004). Chen *et al*. (2002) and Wu and Wang (2005) reported that high compatibility with banking needs will lead to a greater chance of technology acceptance and adoption. When the channel of communication between a bank and its clients is not compatible with the latter's needs, the bank is more likely to fail in offering services and lead to client avoidance. Koenig-Lewis *et al*. (2010) and Marcus (2016) found that PU and PEOU were significantly affected by compatibility. Clients who feel that mobile banking is compatible with their needs are in a better position to evaluate its usefulness and are expected to find it easier to use. Yet, potential customers would not adopt a new service just because of compatibility. Therefore, compatibility is expected to only indirectly affect the intention to use mobile banking but directly affect PU and PEOU. Consequently, the following hypotheses are proposed:

- H_1: compatibility has a positive effect on perceived usefulness

- H_2: compatibility has a positive effect on perceived ease of use

Trialability, perceived usefulness and perceived ease of use: Rogers (2003) defines trialability as 'the degree to which an innovation may be experimented with on a limited basis'. Emerging products and services that can be tested before their full implementation are normally accepted and used faster than those that cannot be tested. Chemingui and Lallouna (2013) and Chen (2013) reported that trialability is positively associated with the adoption rate. Individuals need to try and test a new service or product to fully understand its ease of use and usefulness to their needs and they are more likely to accept and adopt a mobile banking service if they are able to test it to perceive its benefits and see how easy it is to use and therefore develop a positive intention to adopt it. Consequently, the following hypotheses are proposed:

- H_3: trialability has a positive effect on perceived usefulness
- H_4: trialability has a positive effect on perceived ease of use

Observability, perceived usefulness and perceived ease of use: According to Rogers (2003) innovations that is aboserved clearly and visible and facilitates communication among an individual's personal networks creates positive attitudes towards it. Moore and Benbasat (1991) divided the original construct of observability into two, visibility and result demonstrability. Thus, when a client's friends (one of whom is a user of mobile banking) talk about the use of a mobile banking system, potential users will have positive attitudes towards adopting it. When potential users observe the service being used and talk about it they are more exposed to its value and how easy it is to use. As a result, their perception of these two important factors will lead to a more positive intention to adopt mobile banking services. Clients need knowledge about mobile banking and its benefits to facilitate its adoption. Consequently, the following hypotheses are proposed:

- H_5: observability has a positive effect on perceived usefulness
- H_6: observability has a positive effect on perceived ease of use

Perceived ease of use and perceived usefulness and intention to use mobile banking services: In TAM, Davis (1989) and Davis *et al.* (1989) defined PEOU as 'the degree of the user's belief that the usage of a particular system will be out of effort'. They defined perceived usefulness as 'the extent to which a person believes that using a particular system will enhance his or her job performance'. Many researches has been conducted that provide empirical proof of the important effect of PEOU and PU on behavioural intention (Akturan and Tezcan, 2012; Amin *et al.*, 2008; Bhatiasevi and Yoopetch, 2015; Gu *et al.*, 2009; Hanafizadeh *et al.*, 2014; Isaac *et al.*, 2016; Koenig-Lewis *et al.*, 2010; Liu *et al.*, 2009; Martins *et al.*, 2014; Mawona and Mpogole, 2013; Norzaidi *et al.*, 2007; Park and Kim, 2014; Tan and Leby, 2016; Venkatesh, 2000a, b; Yu, 2012). A mobile banking system needs to be easy to learn and easy to use, in order to avoid being under-used'. Moreover, people will be more willing to adopt a mobile banking service if they perceive it to be useful and meet their banking needs. When IT applications are easy to use, clients will be less reluctant to use emerging IS application (Moon and Kim, 2001). This indicates that PEOU and PU are likely to have a positive influence on user intention to adopt a mobile banking system.

While, Aversano (2005) confirmed that intention to adopt a certain behaviour determines actual usage (and therefore, the intention to use mobile banking determines how the system will be used) other studies found that intention to use technology is merely a mediating factor (Venkatesh and Davis, 2000). As this study focuses on individuals who are not using mobile banking services, intention to use such services will be the core construct. Consequently, the following hypothesis is proposed:

- H_7: perceived usefulness has a positive effect on the intention to use mobile banking services
- H_8: perceived ease of use has a positive effect on perceived usefulness
- H_9: perceived ease of use has a positive effect on the intention to use mobile banking services

Moderating effect of income: Mobile banking is one of the newest approaches to providing financial services through information communication technology, made possible by the widespread adoption of mobile phones even in low income countries with explosive growth in markets such as South Africa, the Philippines and Kenya (Anderson, 2010). In their study, Gu *et al.* (2009) found that most of the respondents were employees (64.6%) with 41.1% having an income of one to two million Korean won (940-1880 USD). Laforet and Li (2005) found that

online bank users were also found among salaried employees, senior managers and in the case of mobile banking, small business owners. They were also in a high-income earner's group. Two studies conducted by Sarel and Marmorstein (2003, 2004) showed that household income and education had an important effect on the adoption of e-Banking among mature finnish consumers. Johar and Awalluddin (2011) found out that those earning higher wages tended more to adopt e-Commerce while Abu-Shanab (2013) showed that income moderates the relationship between PU and intention to use e-Banking. Consequently, the following hypothesis are proposed:

- H_{10}: income moderates the relationship between perceived usefulness and the intention to use mobile banking services
- H_{11}: income moderates the relationship between perceived ease of use and the intention ntention to use mobile banking services

MATERIALS AND METHODS

Overview of the proposed research model: The proposed model of this research is based on Technology Acceptance Model (TAM) (Davis, 1989; Davis *et al*., 1989) integrated with the diffusion of innovation model (Rogers, 2003) to explain intention to use mobile banking in Yemen. As suggested by Davis (1989) and Davis *et al*. (1989) the external variables are compatibility, trialability and observability. Relationships among the external variables and the core constructs of TAM (perceived usefulness and perceived ease of use) and the intention to use mobile banking services are demonstrated in Fig. 1.

Development of instrument: A specially designed questionnaire was used to measure all the main constructs of the research model and collect data for this study. It contained close-ended questions that were tested and translated into Arabic since the targeted respondents were from Yemen. The survey is divided into two sections, the first section measuring six core constructs using a seven-point Likert scale ranging from 1 (strongly disagree) to 7 (strongly agree) please refer to Appendix (Table 1). A and B for the instruments while the second assessed the demographic profile of respondents, measured using a nominal or ordinal scale.

Data collection: The respondents of this study, are individuals who satisfied the following criteria:

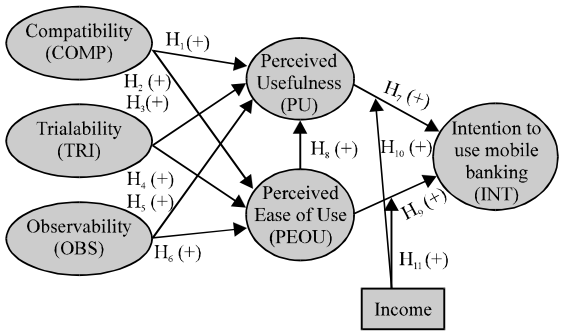


Fig. 1: The integrated research model

- Have a bank account at any bank that provides mobile banking services in Yemen
- Have mobile phones
- Are not users of mobile banking services

In this study, a non-probability sampling technique known as snowball sampling was adopted to reach potential subjects among Yemeni Bank clients in the capital city Sana'a which is appropriate when the target population is difficult to reach (Al-Qeisi, 2009). About 482 valid usable responses were received and analysed, the first part via a multivariate process using Structural Equation Modelling (SEM) Analysis of Moment Structures (AMOS) software version 21.0. AMOS was used because of its simplicity and technically advanced nature (Miles, 2000). Moreover, it offers a more precise assessment of the discriminant validity of an instrument than exploratory analysis (Bagozzi and Phillips, 1982). The second part was analysed through Statistical Package for the Social Sciences (SPSS) Version 22.0

RESULTS AND DISCUSSION

Data analysis and results

Respondents demographics profile: The respondent demographic profile in Table 1 shows that 71% of respondents are male with 29% female. In terms of age, 13 (2.7%) of them are <20 years old, 449 (93.1%) are 20-49 years and 20 (4.1%) are 50 years and above. For banking experience, only 20.3% have used banking services for a year, the majority or 57% have been bank clients for 2-7 years and 22.6% have used banking services for >7 years. For the rest of the demographic profile, please refer to Table 1.

Descriptive analysis and measurement model assessment: The descriptive analysis of the sample

analysed in this study is shown in Table 2, showing the mean and standard deviation of each core variable. The

Table 1: Respondents demographics profile

Demographic item/Categories	Frequency	Percentage
Genders		
Male	342	71.0
Female	140	29.0
Marital status		
Single	127	35.7
Married	300	62.2
Divorced	9	1.9
Widowed	0	0.0
Others	1	0.2
Age (years)		
>20	13	2.7
20-29	184	38.2
30-39	167	34.6
40-49	98	20.3
50-59	18	3.7
60 years and above	2	0.4
Education background		
High school	69	14.3
Diploma	64	13.3
Bachelor degree	315	65.4
Master degree	24	5.0
PhD/DBA degree	8	1.7
Others	2	0.4
Occupation		
Student	114	23.7
Government employee	257	53.3
Private sector employee	73	15.1
Business owner	15	3.1
Unemployed	9	1.9
Others	14	2.9
Gross monthly income (YER)		
>20,000	74	15.4
20,000-39,000	62	12.9
40,000-59,000	87	18.0
60,000-79,000	65	13.5
80,000-99,000	95	19.7
100,000 and above	99	20.5
When did you open your first account? (years)		
1	98	20.3
2	93	19.3
3-5	124	25.7
5-7	58	12.0
>7	109	22.6

results indicate that the level of perceived ease of use and perceived usefulness are both high among respondents in this study. This implies that the respondents expect ease of use, flexibility and usefulness when using mobile banking services. The results also show that the level of perception of compatibility is moderate among respondents, indicating that they find mobile banking compatible with their banking needs. In addition, trialability and observability levels are moderate, implying that bank clients need to test the service themselves before accepting and adopting it and observing others using mobile banking around them moderately affects their acceptance of it. Further, the intention to use mobile banking services in the future is good (4.77 out of 7).

Absolute fit indices determine how well a priori model fits the sample data (Mcdonald and Ho, 2002). Based on the results of Confirmatory Factor Analyses (CFA) the Absolute fit indices show that the chi-square is not significant and this is justifiable by the high sample size (Byrne, 2010), however the model fit reported by the RMSEA coefficient is 0.068 indicating a good fit. The Adjusted Goodness of Fit Index AGFI (0.897) is fit and incremental fit indices indicate that both tests are fit since the NFI and CFI obtained are 0.962 and 0.973, respectively. Finally, Parsimony fit indices also indicate fit, since the PGFI is 0.610 and PNFI is 0.713. Thus, the model fits well. Incremental fit indices indicate that both tests are fit since the CFI obtained is 0.973 and thus the model fits well (Byrne, 2010; Kline, 2010). The CFA model in the current study tested all variables simultaneously, not individually because the hypothesised model integrates a small number of items for each of the latent variables. Generally,

Table 2: Mean, standard deviation, loading, Cronbach's alpha, Composite Reliability (CR) and Average Variance Extracted (AVE)

Constructs	Items	Loading (above 0.5)	M	SD	α (>0.7)	CR (>0.7)	AVE (>0.5)
PEOU	PEOU1	0.83					
	PEOU2	0.90	4.94	1.76	0.876	0.886	0.722
	PEOU3	0.82					
PU	PU1	0.92	4.85	1.86	0.947	0.947	0.857
	PU2	0.92					
	PU3	0.94					
COMP	COMP1	0.88	4.31	1.98	0.868	0.868	0.767
	COMP2	0.87					
TRI	TRI1	0.91	3.87	1.70	0.856	0.860	0.754
	TRI2	0.83					
OBS	OBS1	0.85					
	OBS2	0.90	3.829	2.11	0.833	0.843	0.646
	OBS3	0.63					
INT	INT1	0.94					
	INT2	0.96	4.77	1.88	0.964	0.964	0.900
	INT3	0.94					

M = Mean; SD = Standard Deviation; α = Cronbach's alpha; CR = Composite Reliability, AVE = Average Variance Extracted (the measurement used is seven-point scale ranging from 1 (strongly disagree) to 7 (strongly agree); Key: PEOU: Percieved Ease of Use, PU: Perceived Usefulness, COMP: Compatibility, TRI: Trialability, OBS: Observability, INT: Intention to Use mobile banking services

Table 3: Goodness-of-fit indices for the measurement model

Fit Index	Cited	Admissibility	Results	Fit (Yes/No)
χ^2	-	-	278.982	-
df	-	-	89.000	-
p-value	-	>0.05	0.000	No
χ^2/df	Kline (2010)	1.00-5.00	3.135	Yes
RMSEA	Steiger (1990)	<0.08	0.067	Yes
GFI	Joreskog and Sorbom (1993)	>0.90	0.932	Yes
AGFI	Joreskog and Sorbom (1993)	>0.80	0.897	Yes
NFI	Bentler and Bonnet (1980)	>0.80	0.962	Yes
PNFI	Bentler and Bonnet (1980)	>0.05	0.713	Yes
IFI	Bollen (1990)	>0.90	0.974	Yes
TLI	Tucker and Lewis (1973)	>0.90	0.964	Yes
CFI	Byrne (2010)	>0.90	0.973	Yes
PGFI	James *et al.* (1982)	>0.50	0.610	Yes

χ^2 = Chi-square, df = degree of freedom, GFI = Goodness-of-Fit, NFI = Normed Fit Index, IFI = the Increment Fit Index, TLI = Tucker-Lewis coefficient Index, CFI = Comparative-Fit-Index, RMSEA = Root Mean Square Error of Approximation, PNFI = Parsimony Normed Fit Index, AGFI = Adjusted Goodness of Fit Index (the indexes in bold are recommended, since they are frequently reported in literature (Awang, 2014)

Table 4: Results of discriminant validity by Fornell-Larcker criterion

Factors	PEOU (1)	PU (2)	COMP (3)	TRI (4)	OBS (5)	INT (6)
PEOU	0.850					
PU	0.726	0.926				
COMP	0.587	0.675	0.876			
TRI	0.576	0.593	0.599	0.868		
OBS	0.357	0.428	0.557	0.593	0.804	
INT	0.757	0.754	0.670	0.669	0.468	0.949

Diagonals represent the square root of the average variance extracted while the other entries represent the correlations;Key: PEOU: Percieved Ease of Use, PU: Perceived Usefulness, COMP: Compatibility, TRI: Trialability, OBS: Observability, INT: Intention to use mobile banking services

the goodness-of-fit statistics (Table 3) support the integrity of the overall model. In the current study, the overall model fit reported in Table 3 show that the overall fit indices for the CFA model are acceptable (Byrne, 2010; Hair *et al*., 2014; Kline, 2010, 2011), since incremental fit indices and Parsimony fit indices are fulfilled (Table 3).

Before testing the hypotheses in Table 2, convergent validity of the measurement model was tested on the CFA model, by examining the factor loading, composite reliability and Average Variance Extracted (AVE). High loadings (at least 0.50) on a factor indicate that the items converge on the same common point (Hair *et al*., 2014). The composite reliability is the same acceptable cut-off for the Cronbach's alpha (at least 0.70). High AVE values (>0.5) show that the latent variables have high convergent validity (Hair *et al*., 2014). The results for composite reliability reveals values >0.7 and AVE values >0.5 and therefore, all variables have convergent validity (Hair *et al*., 2010).

The Fornell-Larcker criterion is a more conservative approach to assessing discriminant validity and compares the value of the AVE with the latent variable correlations. Specifically, the AVE should exceed the correlation with any other construct (Hair *et al*., 2013). Table 4 represents the Fornell-Larcker criterion for this study and shows that the AVE exceeds the correlation with any other construct.

Structural model and hypotheses testing: The goodness-of-fit of the structural model is comparable to the previous CFA measurement model. In this structural model, the χ^2/df = 3.202, CFI = 0.972 and RMSEA = 0.068. These fit indices provide evidence of adequate fit between the hypothesised model and the observed data (Byrne, 2010). All the hypotheses were tested using structural equation modelling via AMOS Software Version 21.0 as shown in Fig. 2. The structural model fit as shown in Table 5 shows the result of the hypotheses tests. The p-values associated with each standardised path estimate are used to determine significance at an alpha level of 0.05.

Nine constructed hypotheses were examined and results are shown in Table 6. The Structural Equation Modelling (SEM) analysis indicates that compatibility remarkably predicts perceived usefulness (β = 0.324, $p<0.001$) and also significantly predicts the perceived ease of use (β = 0.404, $p<0.001$). Thus, H_1 and H_2 are supported. H_3 and H_4 are supported as trialability significantly impacts the perceived ease of use and perceived usefulness with β = 0.365 and β = 0.126, respectively. On the other hand, observability did not predict ease of use and usefulness since the β values were 0.027 and -0.047, respectively and accordingly H_5 and H_6 are not supported. Perceived usefulness greatly predicts intention to use mobile banking (β = 0.685, $p<0.001$) and hence H_7 is

Table 5: Structural path analysis result

H	Dependent variables	Independent variables	Path coefficients (β)	SE	CR (t-values)	Finding
H_1	PU	COMP	0.324	0.058	6.056***	Supported
H_2	PEOU	COMP	0.404	0.053	6.425***	Supported
H_3	PU	TRI	0.126	0.057	2.521*	Supported
H_4	PEOU	TRI	0.365	0.054	5.966***	Supported
H_5	PU	OBS	0.027	0.061	0.608	Not supported
H_6	PEOU	OBS	-0.047	0.059	-0.855	Not supported
H_7	INT	PU	0.685	0.040	16.689***	Supported
H_8	PU	PEOU	0.452	0.064	9.191***	Supported
H_9	INT	PEOU	0.262	0.052	6.454***	Supported

PEOU: Percieved Ease of Use, PU: Perceived Usefulness, COMP: Compatibility, TRI: Trialability, OBS: Observability, INT: Intention to use mobile banking services; ***, **, *p<0.001; 0.01; 0.05; SE: Standard Error; CR: Critical Ratio

Table 6: The moderation effect of income (low income and high income)

H	Income	Dependent variables	Estimate β (path coefficient)	SE	CR (t-value)	p-values	Results
H_{10}	Low	INT<--PU	0.75	0.124	6.626	***	Significant
	High	INT<--PU	0.57	0.126	4.034	***	Significant
H_{11}	Low	I NT<--PEOU	0.08	0.114	0.757	0.449	Not significant
	High	INT<--PEOU	0.36	0.217	2.628	**	Significant

Key: PEOU: Perceived Ease of Use, PU: Perceived Usefulness, INT: Intention to use mobile banking services (***, **, *p<0.000; 0.01; 0.05, SE: Standard Error, CR: Critical Ratio)

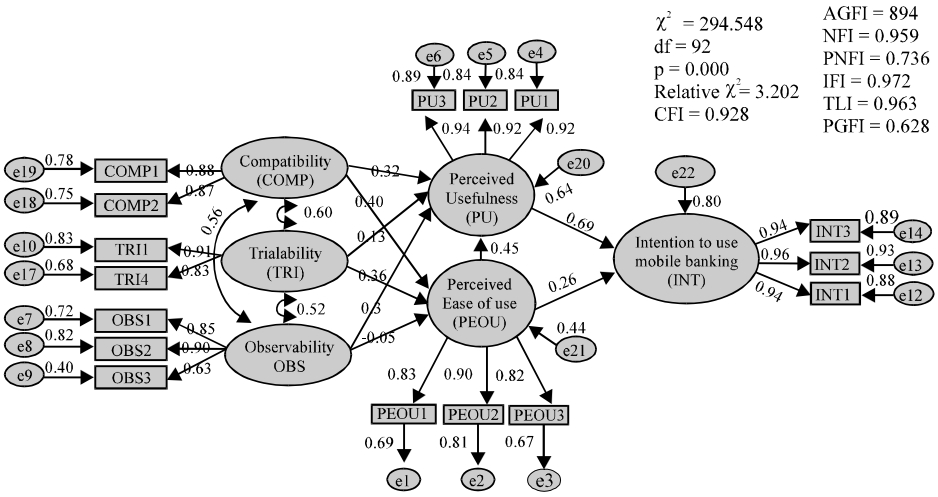


Fig. 2: Research structural model results

supported. In the same way, H_8 and H_9 are supported as perceived ease of use was found to be an important antecedent of perceived usefulness and intention to use mobile banking services with $\beta = 0.452$ and $\beta = 0.262$, respectively.

The coefficient of determination for the proposed research model shows that compatibility, trialability and observability explained 44% of the variance in perceived ease of use. However, compatibility, trialability, observability and perceived ease of use explain 64% of the variance in perceived usefulness of using mobile banking services. Further, 80% of the variance of intention to use mobile banking is explained by perceived usefulness and perceived ease of use. According to Chin (1998), Cohen (1988) and Hair *et al.* (2013) the R^2 of the intention to use mobile banking services in the current study is considered substantial.

Assessment of the moderating effect of income on the PEOU and PU: A moderating variable is the one that 'moderates the effects' of an Independent Variable (IV) on a Dependent Variable (DV) (Awang, 2014). And according to Hayes (2013) moderation plays an important role in many social science theories. This study examines how the relationship between perceived ease of use, perceived usefulness (predictors) and intention to use mobile banking services (outcome) changes as a function of income (moderator). This section tested the moderation hypotheses as follows:

- H_{10}: income moderate the relationship between perceived usefulness on the intention to use
- H_{11}: income moderate the relationship between perceived ease of use on the intention to use

If the effects of perceived ease of use on intention to use are more visible on certain income level groups, then one could claim that income level moderates the relationship between perceived ease of use and intention to use mobile banking services (Awang, 2014). This is similar to the moderating effect of income level on the relationship between perceived usefulness and intention to use mobile banking services.

Two hypotheses were tested (H_{10} and H_{11}) to achieve objectives 10 and 11 in this study. As shown in Table 6, there is no difference between low income and high income groups, where both have a strong positive effect on the relationship between perceived usefulness and intention to use mobile banking services. So H_{10} is not accepted. On the other hand, the high income group has a strong positive effect on the relationship between perceived ease of use and intention to use mobile banking services while the low income group shows no effect between perceived ease of use and intention to use mobile banking services. So, H_{11} is accepted, indicating that income moderates the effect of perceived ease of use on the intention to use mobile banking services.

In this study, an integration of IDT and TAM was tested through the proposed model to investigate the factors that impact the intention to use mobile banking services among Yemeni bank clients. As the original TAM suggests, there are external variables that effect PEOU and PU (Davis, 1989; Davis *et al*., 1989). Specific objectives H_1 and H_2 were tested empirically to achieve specific objectives 1 and 2. This study has given new insights into the importance of compatibility in the acceptance of mobile banking in Yemen as compatibility had an indirect (through the PEOU and PU) significant impact on the intention to use mobile banking and was found statistically substantial to influence perceived usefulness ($\beta = 0.324$) and perceived ease of use ($\beta = 0.404$). Client evaluation as to whether the new technology will be compatible with their needs was shown to be significant. Indicating that if clients perceive mobile banking to be consistent with their banking needs, they are more likely to use these services and more likely to perceive their ease of use and usefulness. Hence, compatibility is revealed to be a significant antecedent of the core factors of TAM in the context of mobile banking and this is consistent with the findings of Agarwal and Karahanna (1998) and Oh *et al*. (2003). It is also in line with Koenig-Lewis *et al*. (2010) who revealed the direct and indirect significance of compatibility on the intention to use mobile banking services. Accordingly, H_1 and H_2 are supported.

Trialability as an antecedent of PEOU and PU has been tested through an assessment of the structural model to accomplish objectives 3 and 4. In this study, trialability has proven the importance of its effect on perceived ease of use and perceived usefulness. Interestingly, the results showed that it has more influence on the PEOU than PU with $\beta = 0.365$, $\beta = 0.126$, respectively which gives an insight that when clients are given the opportunity to try mobile banking services, they understand how easy it is to use and learn. While its impact on PU is still significant which also implies that clients will discover more about its benefits and value, this is still less than the PEOU. Ultimately, trialability was found to be a notable factor affecting the intention to use mobile banking indirectly through the perception of ease of use and usefulness of the service. Based on the above results, H_3 and H_4 are supported.

It was surprising to note that the indirect effect of observability on intention to use mobile banking services and its influence on the perceived ease of use were both found to be not significant ($\beta = 0.047$, $p = 0.392$). Its effect on the PU was not significant as well ($\beta = 0.027$, $p = 543$). This may be because Yemeni clients need more than noticing the service being used and talking about it and would prefer to try and test for themselves before accepting and adopting such a service. They have more concerns about how compatible the service is with their needs when considering the adoption of the services. Through this study, the innovation factor suggested by Rogers (2003) was found not to be a critical factor in influencing the intention to use mobile banking in Yemen. Thus, objectives 5 and 6 were not achieved as H_5 and H_6 were not supported.

TAM (Davis, 1989; Davis *et al*., 1989) suggested objectives 7-9 as the researchers theorised that PEOU predicts perceived usefulness and both PEOU and PU are antecedents of the intention to use new technology. In this study, perceived ease of use was found to be a significant predictor of perceived usefulness with ($\beta = 0.452$) therefore, the higher the perceived ease of use of mobile banking services, the greater the perceived usefulness among Yemeni bank clients and this is consistent with earlier studies. Gu *et al*. (2009) and Tan and Leby (2016) in a different context and

application, reported the significant positive influence of the PEOU on the PU. It is confirmed that there is a significant direct effect of PEOU and PU on potential users and their intention to adopt mobile banking with (β = 0.262, 0.685), respectively. The results reported in this study are in line with Kim *et al.* (2008), Luarn and Lin (2005) who showed empirically that perceived usefulness and ease of use have a positive influence on the intention to use mobile banking services. The H_7-H_9 are therefore supported and have achieved the related objectives. The results notably indicate that ease of use and usefulness are important predictors of intention to use in the initial adoption stage of mobile banking services (Guriting and Ndubisi, 2006; Riffai *et al*., 2012; Sathye, 1999; Zolait, 2010). The 80% variance in the intention to use mobile banking services is explained through compatibility, trialability, observability, perceived usefulness and perceived ease of use.

The H_{10} was tested to explore the moderation effect of income between perceived usefulness and intention to use mobile banking services and the test result shows that perceived usefulness directly effects the intention for both low and high income groups. Therefore, income is not an attenuator or stimulant for the relationship between usefulness and intention among Yemeni bank clients, indicatiing that both high and low-income client intention to use mobile banking is influenced by perceived usefulness. The moderating effect of income on the relationship between perceived ease of use and intention was also found to be significant. The results show that for low income Yemeni bank clients, ease of use was not a driver for the intention to use mobile banking, as clients need more than this to be motivated to use such a new technology. However, it will stimulate the intention through perceived usefulness. On the other hand, for high income Yemeni bank clients, ease of use is a direct driver for their intention to use mobile banking services, since these clients have no financial barrier concern.

CONCLUSION

The objective of this study was to investigate the factors affecting the intention of Yemeni bank clients to use mobile banking services. A proposed research model based on TAM and IDT was empirically validated. The results from the analysis of the collected data indicates that the model was able to explain the factors that influence client intention to accept the new technology as well as to investigate the impact of innovation factors on TAM main factors. In spite of the limitations of this study, the results have shed some encouraging light on new variables of mobile banking service acceptance in Yemen. In summary, both compatibility and trialability improve the perception of ease of use and usefulness of mobile banking, since both positively affect the core constructs of TAM and therefore the intention to use such services. In addition, banks need to present something new to their clients among services that compete in the same category (e.g., e-Banking). Perceived usefulness has a great impact on the intention to use mobile banking services. As showed by this research, after the bank clients evaluate mobile banking services based on their perceptions of its ease of use, usefulness, associated with compatibility and trialability with their banking needs, their decision toward intention to use mobile banking services will be much more positive. The study results clearly show that COMP and TRI are important antecedents of PU and PEOU and therefore predict the intention to use mobile banking services. Moreover, income plays a major moderating role in the relationship between how easy a mobile banking service is to use and the intention to adopt it. Low income Yemeni clients will need more than ease of use to affect their decision to adopt it and therefore their intention will be stimulated through perceived usefulness. The findings of this study also presented several crucial implications for mobile banking service practitioners and researchers.

LIMITATIONS

Like any other research, this study has some limitations that should be overcome in future studies. First, although the investigation of mobile banking acceptance in this study suggests five factors to measure client intention to accept and adopt it, these constructs can be integrated with others to provide a more comprehensive understanding of mobile banking acceptance and to accurately predict adoption intention. Second, in this research, the snowball sampling technique employed may have produced a sample which is not representative of the entire population and which can be overcome by using different sampling techniques in future research. Finally, a significant limitation as shared by many consumer adoption studies is that it this study can only measure intention to use mobile banking and not usage behaviour, given the relatively new nature of mobile banking services in Yemen. Future studies should investigate the causality between adoption intention and actual usage behaviour.

IMPLICATIONS

This study revealed that the integration of TAM and IDT was found to be robust in determining client intention to adopt mobile banking services in Yemen. Given that the take up of mobile banking is completely voluntary and that target user group consist of a large number of people from diverse backgrounds, the findings of this study suggest that in order to attract more people to use mobile banking services and make them satisfied with the system, it is not enough for clients to observe the use of mobile banking. It is of paramount importance to develop a mobile banking system that provides high compatibility with their needs. In addition, developers and service providers need to expand their client base by taking potential clients through a mobile banking system simulation to see how it can be relevant and important to them.

As also shown in earlier studies, bank clients are more likely to adopt mobile banking services if the service is easy to use and useful. Developers of mobile banking platforms need to work together with banks to invest resources and effort to create effective mobile banking applications that prioritise ease of use and usefulness as both increase the chance of customer acceptance of mobile banking services. Since mobile banking perceived usefulness and perceived ease of use of mobile banking considerably affect customer intention, in addition to providing customers with rich information and hi-tech platforms, it is important that banks take more care about client perceptions of ease of use and usefulness. This is particularly important, given the lack of familiarity ofYemeni clients with e-banking services. For instance, banks could focus on the most desired mobile banking services such as account information and balance checking, electronic bill payment, money transfer, credit card payment and summary transaction reports. This might raise the usefulness of new technology and simplify mobile banking applications for users, creating a user-friendly, peace-of-mind and informative environment. These factors are significant for a potential client when making the decision whether to use mobile banking services or not. Is the technology easy to use and is there direct usefulness of the service with regard to efficiency, convenience and quality?

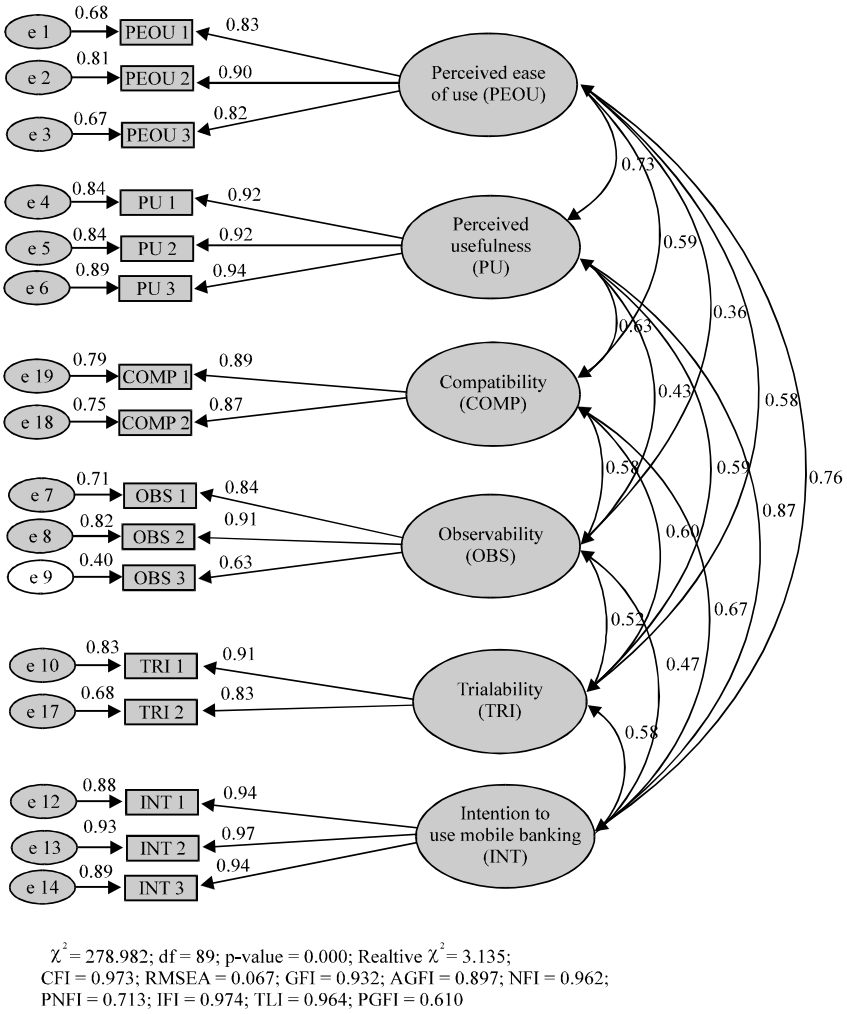
The integrated model of TAM and IDT in this study validates compatibility, trialability and observability as external antecedents of perceived ease of use and perceived usefulness which in turn affects the intention to use mobile banking services. The results of the current study can be added to the body of literature for researches on mobile banking in Yemen. The findings of the current research have significant suggestions that will be very helpful for the banking sector and also beneficial for the governmental-related authorities to draw more clients and users for banking services.

APPENDIX

Appendix A: Instrument for construct

Construct constructs	Items	Sources
Perceived Ease of Use (PEOU)	I would find mobile banking easy to use	Yu (2012)
	Learning to use mobile phone banking would be easy	Hanafizadeh *et al.* (2014)
	I would find mobile banking services to be flexible to interact with	Liu *et al* (2008)
Perceived Ease of Use (PEOU)	I would find mobile banking easy to use	Yu (2012)
	I think using Mobile banking would enable me to accomplish more banking activities	Al-Somali *et al.* (2009)
	I think that Using mobile banking services will enhance my effectiveness in conducting my banking tasks	Lee *et al.* (2012)
Compatibility (COMP)	Using mobile phone banking would be compatible with most aspects of my banking activities	Hanafizadeh *et al.* (2014)
	Mobile banking would be compatible with my Banking needs	(Rui-jin)
Trialability (TRI)	I would use or be more likely to use mobile banking if I could test cell phone banking first	Brown *et al.* (2003)
	A trial would convince me that using mobile banking is better than other banking means	(Olatokun)
Observability (OBS)	Friends around me discuss the use Mobile Banking	Chen (2013)
	It is easy for me to observe others using the mobile banking in my work	Park and Chen (2007)
	I have had a lot of opportunity to see the mobile banking being used	Park and Chen (2007)
Intention (INT)	Assuming I have access to the mobile banking system, I intend to use it	Venkatesh And Davis (2000)
	I would use the Mobile banking for my banking needs	Nasri and Charfeddine (2012a, b)
	If I have access to the mobile banking system	Haderi and Saleh (2012)
	I want to use it as much as possible	

Appendix B:



χ^2 = 278.982; df = 89; p-value = 0.000; Realtive χ^2 = 3.135;
CFI = 0.973; RMSEA = 0.067; GFI = 0.932; AGFI = 0.897; NFI = 0.962;
PNFI = 0.713; IFI = 0.974; TLI = 0.964; PGFI = 0.610

Fig. 1: Confirmatory Factor Analysis (CFA)

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