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Application of Technology Acceptance Model (TAM) in M-Banking Adoption in Kenya

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Abstract

Mobile phones with Mobile Commerce technology are becoming more readily available in Kenya. Similarly many financial institutions and mobile phone service providers are teaming up to provide banking services to customers via the mobile phone. However the number of people who choose to adopt or use such technologies is still relatively low. Therefore there is need to assess the acceptance of such technologies to establish factors that hinder or promote their acceptance. This study applied Technology Acceptance Model to examine the factors that influence the adoption of M-banking in Kenya. The study specifically focused on the evaluation of M-Kesho, an M-banking application in Kenya. A survey was conducted to gather data which was coded in SPSS 16. Confirmatory Factor Analysis was used to analyze the data and Structural Equation Modeling using Analysis of Moment Structures was used to validate the research model. Out of a total of 450 questionnaires distributed to M-Kesho users, 395 were returned and validated. The analysis revealed that Perceived Ease of Use, Perceived Usefulness, Perceived Self Efficacy and Perceived Credibility significantly influenced customers' attitude towards usage of M-banking. The results of the data analysis contributes to the body of knowledge by demonstrating that the above factors are critical in attitude towards usage of M-banking in a developing country context. The implications of the results form a good basis for providing practical recommendations to the banking industry, and directions for further work.

Keywords: M-banking, Technology Acceptance Model, Adoption

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1. INTRODUCTION

Today's major technologies enable people to collect, send and receive information in minutes wherever they are. The area of wireless device to conduct Mobile Commerce or Mobile Business has emerged as a new communication network and become one of the major topic of research in the last few years particularly in developing countries. According to Keen and Mackintosh, 2001 technological features play an important role in the adoption of mobile value added services. In service use, mobile phones are no longer used as they have typically been used before. Though talking and text messaging (SMS) are likely to remain, different forms of usage are developing and expected to grow.

Mobile banking, commonly referred to as M-banking, is an innovation which has been perpetuated by the wide spread of this mobile communication technology. M-banking is defined as the financial services delivered via mobile networks and performed on a mobile phone (Bangens and Soderberg, 2008). Research has shown that mobile communications has a potential of leapfrogging traditional infrastructure; M-banking has great potential to extend the provision of financial services to unbanked people through a technology that is both familiar and widespread.

In Kenya, adoption of M-banking services is still very low compared to mobile operator led transfer services using mobile phones. Unlike mobile money transfer services operated by mobile network operators, M-banking promises a lot more to the users, including interest on funds saved, credit history and access to loans. This leads to questioning the banking sector as to whether the un-banked user has been well understood. There is a need to understand users' acceptance of M-Banking and to identify the factors influencing their intentions to use M-banking. This information can assist developers to build M-banking systems that consumers want to use, or help them to discover why potential users avoid using the existing system.

M-Kesho is one of the famous M-Banking products in Kenya. It was developed and promoted by the most dominant mobile operator (Safaricom) and the leading bank in terms of bank accounts (Equity Bank). 'M' represents 'Mobile' while 'Kesho' is a Swahili word for 'tomorrow or future'. The service is geared towards reaching the unbanked population by enabling them to easily open bank accounts, save money into the bank account and enjoy the other benefits of a bank account while accessing it through their phone. M-Kesho is nevertheless used by both the banked and the unbanked. Though there are other M-Banking services in Kenya, M-Kesho promises to reach a much wider target considering the collaboration of Safaricom and Equity bank who have a customer base of over 17 million and 5 million respectively in a country of 40 million people. It's therefore worth studying M-Kesho as a representative of M-banking in Kenya.

2. RESEARCH MODEL AND HYPOTHESIS

2.1 Technology Acceptance Model (TAM)

There are several models existing that have been used to investigate adoption of technology. Several studies focusing on adoption of mobile services have their roots in Technology Acceptance Model (TAM) originally proposed by Davies in 1986. The model is originally designed to predict user's acceptance of Information Technology and usage in an organizational context. TAM focuses on the attitude explanations of intention to use a specific technology or service; it has become a widely applied model for user acceptance and usage. There are a number of meta-analyses on the TAM that have demonstrated that it is a valid, robust and powerful model for predicting user acceptance (Bertrand and Bouchard, 2008). TAM, shown in figure 1 was also the first model that established external variables (shown as X1, X2 and X3 in figure 1) as key factors in studying technology adoption.

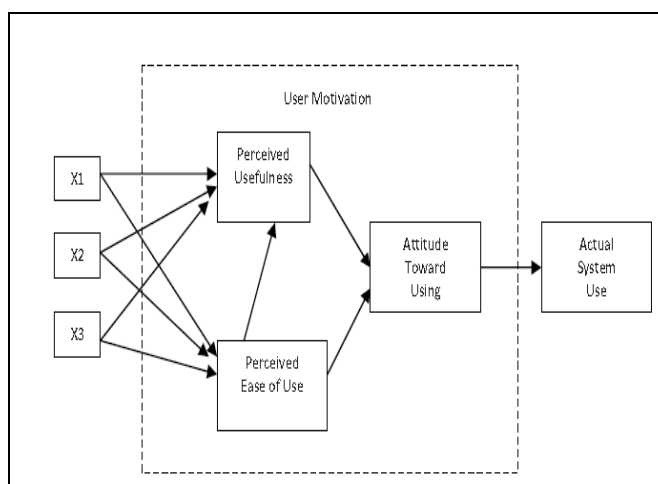


Figure 1: Technology Acceptance Model (Davis, 1989)

TAM model which deals with perceptions as opposed to real usage, suggests that when users are presented with a new technology, two important factors influence their decision about how and when they will use it (Davis, 1989). These key factors are:

- Perceived usefulness (PU) - This was defined by Davis as "the degree to which a person believes that using a particular system would enhance his or her job performance".
- Perceived ease-of-use (PEoU) - Davis defined this as "the degree to which a person believes that using a particular system would be free from effort"

2.2 Limitation of TAM to Study M-Kesho Application

TAM tries to explain the adoption process and underlying influencing factors in technology acceptance. The model has been used widely in IS research (Arbuckle, 1995). However, the model has a number of limitations in studying mobile based services (Nysveen et al, 2005). One of the limitation of TAM is that it was designed to be used in an organizational context rather than in everyday life context making it not favorable to study mobile based technology. M-Kesho is an everyday life context application which links mobile telephony and banking industry therefore cannot sufficiently be studied by TAM. Besides, users incur a cost when transacting using M-Kesho, a parameter that could significantly influence usage. There are other variables which could influence M-banking adoption that are not present in the TAM and should be considered.

TAM is also limited in explaining various forms of technology which is a common characteristic in the innovation in mobile telephony. M-Kesho is one such innovation. Therefore, to study mobile based services, TAM needed to be extended. This study address this issues, it investigates factors that enhance the acceptance of M-banking in Kenya using M-Kesho as a case study. The study adapts TAM and extends it in studying M-banking in Kenya.

2.3 Research Model Adoption

Previous research has suggested that trust-related constructs and resource related constructs should be the critical antecedents of the behavioral intention to use information systems. Based on the information systems acceptance literature, especially the extended TAM by Luarn & Lin, 2004, this research adopts the research model indicated in Figure 2. The construct perceived Subjective Norms (SN) absent in the Luarn & Lin's (2004) model is proposed. This construct has been proposed as a determinant of M-banking adoption in several research such as: Fishbein, and Ajzen (1975) in the theory of Reasoned Action; Mathieson (1991) in the Theory of planned Behavior (TPB); Julio et al., 2010 in the study M-banking, proposition of an integrated adoption intention framework among other studies. The constructs added to the original TAM in this research are shown in Table 1.

Table 1: Constructs added to the original TAM

Variable	Definition	Source
Self Efficacy (SE)	The degree to which a person's confidence in her/his ability to use banking.	Bandura (1982)
Perceived Credibility (PC)	Perceived credibility is a determinant of behavioral intention to use an information system. Perceived credibility consists of two important elements: privacy and security	Luarn & Lin (2004)
Subjective Norms (SN)	Represent the degree to which a person perceives that important others believe he or she should use banking	Taylor and Todd (1995)
Transaction	The transaction cost of	Luarn & Lin

Cost (TC)	using M-banking service.	(2004)
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As noted by Davis (1989), future research of Information System and Information Technology usage has to address the other variables which affect usefulness, ease of use and user acceptance. Consequently these two determinants may not fully explain the factors which predict the acceptance of a technology application such as M-banking. Prior studies have extended the original TAM by adding constructs, such as perceived playfulness (Moon & Kim, 2001), perceived enjoyment (Koufaris, 2002) and perceived credibility, Wang et al, 2003.

Perceived Usefulness, Perceived Ease of Use, Attitude

The constructs **Perceived Usefulness (PU)**, **Perceived Ease of Use (PEoU)** and **Attitude towards Adoption (ATA)** of M-banking were adapted from TAM. These constructs have also been maintained for studying the adoption of mobile services where results fairly well comply with the findings from TAM studies.

TAM posits that a user's acceptance of information system is determined by that user's intention to use the systems, while perceived usefulness and ease of use can predict the usage intention, and perceived ease of use is hypothesized as a predictor of perceived usefulness. According to TRA, users' beliefs influence their attitude, which in turn influence behavioral intention. Both perceived usefulness and perceived ease of use are beliefs. Thus, they will affect user's attitude. In addition, TAM states that perceived ease of use will have a direct effect on perceived usefulness.

We therefore make the following assumptions:

H1: User's attitude to use M-banking has a significant effect on behavioral intention to use.

H2: Perceived usefulness has a significant effect on attitude to use M-banking.

H3: Perceived ease of use has a significant effect on attitude to use M-banking.

Perceived Credibility

Perceived credibility consists of two important elements namely privacy and security. Further, security refers to the protection of information or systems from unsanctioned intrusions or outflows (Nysveen et al, 2005). Fear of the lack of security is one of the factors that have been identified in most studies as affecting the growth and development of technology including M-banking adoption.

Accordingly, perceived usefulness and ease of use may not fully explain behavior attitude to use M-banking. Wang examined the impact of perceived credibility on usage intention, and found that perceived credibility had a significant effect on intention (Nysveen et al, 2005). Considering the context of M-banking services this study extends TAM by adding perceived credibility to the model to explain user acceptance of M-banking.

We propose the following hypothesis:

H4: Perceived credibility has a positive effect on behavioral intention to use M-banking

Normative Pressure

This construct was promoted by Theory of Reasoned Action (TRA) by Fishbein and Ajzen (1975)]. It was also included in the extended TAM. Subjective Norm (SN) or Normative Pressure (NP) is defined as a person's perception that most people who are important to her or him should or should not perform the behavior in question (Fishbein and Ajzen, 1975). Previous studies have explored the importance of such construct in social science studies including in banking studies (Nysveen et al, 2005) who examined mobile chatting usage in Norway, and found that SN is an important driver for mobile chatting usage among the Norwegians.

In view of these studies, it is important to examine whether this construct is able to provide a clear direction as a key predictor for M-banking use.

Using the findings of the above mentioned studies, we propose the following hypothesis:

H5: Normative Pressure will positively influence intention to use M-banking.

Transaction Cost

Transaction cost is an important factor for users considering whether to use M-banking services. If consumers perceive the transaction cost of M-banking service as acceptable, they are likely to adopt it and then use it. According to Mathieson et al. 1991, economic motivations and outcomes are most often the focus of IS acceptance studies.

This variable was used in prior research on M-banking adoption (Luarn and Lin, 2004). The cost consideration may prevent many people from choosing M-banking service (Ibid). Moreover, hardware/software and financial resources are important for users of an Information System (Mathieson, 1991). Based on the literature transaction cost is likely to directly influence the user's intention to use M-banking.

The following hypothesis is then proposed:

H6: Transaction cost will have a negative effect on behavioral intention to use M-banking.

Self Efficacy

Findings from previous studies (Wang et al, 2003, Nysveen et al, 2005, Mathieson et al, 2001) have confirmed the importance of appropriate levels of perceived self-efficacy in technology adoption decisions. Self Efficacy (SE) is the degree to which a person's confidence in her/his ability to use banking (Bandura, 1982).

In their study found strong support for their hypothesis that domain-specific self-efficacy influence the perceived ease of use in two studies. Correspondingly, our research assumes that users with higher levels of perceived SE are more likely to adopt M-banking than those who perceive themselves to be lacking in such skills.

Hence, we formulate the hypotheses:

H7a: Self Efficacy positively influences the behavioral intentions to adopt M-banking.

H7b: Self Efficacy positively influences the perceived ease of use of M-banking.

2.4 Research Model

Based on the above arguments, this research integrates TAM with four additional variables shown in table 1 to investigate adoption of M-banking. The constructs of perceived ease of use, perceived usefulness, attitude to use, and adoption were retained according to TAM. Perceived credibility, transaction cost and perceived self efficacy were included in Luarn & Lin, 2005 research. Perceived normative pressure was adapted from the study of Julio, et al, 2010. Figure 2 shows the research model used in this study.

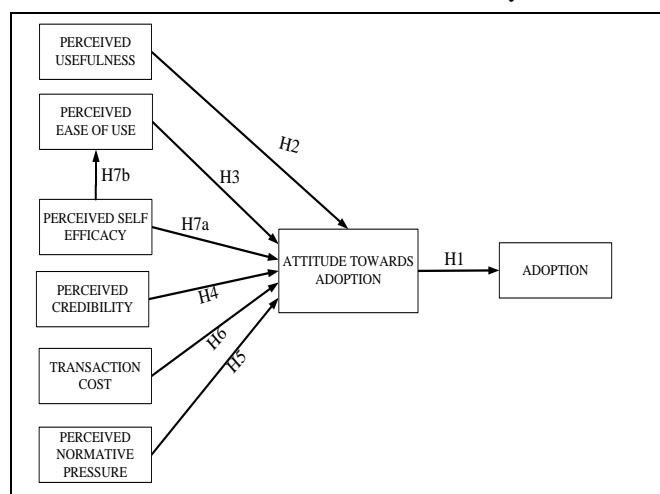


Figure 2: The proposed research model.

3. RESEARCH METHODOLOGY

3.1 Measurement Instrument Development

The instrument used in this research was questionnaire. Items selected for the constructs were mostly adapted from prior studies in order to ensure content validity. Items measuring perceived usefulness, ease of use, attitude and intention to adopt were taken from Davies (1989), items to measure perceived credibility and transaction cost were adapted from Luarn & Lin (2005), perceived self efficacy were measured by items adapted from Bandura (1982), and items of perceived normative pressure usage were taken from Taylor & Todd (1995). The items were modified to make them relevant within the context of M-banking services. A 7-point Likert scale with anchors ranging from "strongly disagree" to "strongly agree" were used for all questions. Questions on demographics characteristics, frequency of use, and length of use of M-banking were included at the end of the questionnaire. Pre-testing of these measures was conducted through selected M-Kesho users and the instrument was validated.

3.2 Data collection

Data used to test our research model were collected from a sample of respondents of M-Kesho users within Nairobi city. At the point of this study, M-Kesho was still being piloted with limited operations beyond the capital city, Nairobi.

We distributed 450 questionnaires and obtained 395 completed which was close to the 390 respondents projected in this research. The response rate of 87.78% was attributed to the eagerness of respondents in using this technology.

Table 2 shows the demographics of the respondents. There were more male (52%) than female; the age group 21 – 30 years had more users (47.60%) than any other, the married and un-married were almost equal; Diploma and high school graduates where the majority (over 60%), while over 75% of the respondents had an income level of below Kenya Shillings 50,000 (USD 625). Those who had not used M-banking for more than one year (63%) indicated that M-Kesho had had a significant impact on M-banking in Kenya. The result also indicates that most of the respondents use the services less than once per week (43.70%), an indication that M-banking adoption is still in its early stages in Kenya.

Table 2: Demographics Characteristics

Variable	Classification of Variables	Frequency	Percentage
Gender	Male	204	52%
	Female	190	48%
Age	21 – 30 yrs	188	47.60%
	31 – 40 yrs	154	39%
	41 – 50 yrs	40	10.10%
	Above 51 yrs	13	3.30%
Marital Status	Single	181	45.80%
	Married	185	46.80%
	Other	27	6.80%
Current Occupation	Professionals	21	5.30%
	Manager	23	5.80%
	Senior Executive	22	5.60%
	Supervisor/Clerical Officer	66	16.70%
	Skilled and Semi skilled	108	27.30%
	Other	130	32.90%
Level of Education Completed	PhD	4	1.0%
	Masters	16	4.10%
	Bachelors Degree	88	22.30%
	Diploma	160	40.50%
	High School Qualification	94	23.80%
	Others	23	5.80%
Monthly Income Range	Below 10,000	99	25.10%
	10,001 - 20,000	123	31.10%
	20,001 - 50,000	90	22.80%
	50,001 - 100,000	31	7.80%
	Above 100,000	10	2.50%

4. RESULTS

4.1 Data Validity and Reliability

We first analyzed the data for convergent and discriminant validity to examine the reliability of the scale as proposed by Straub et al., 2004. Convergent validity is shown when each measurement item correlates strongly with its assumed theoretical construct, discriminant validity requires an appropriate Average Variance Extracted (AVE) analysis. We tested to see if the square root of every AVE is much larger than any correlation among any pair of latent construct. The square root of each construct should be much larger than the correlation of the specific construct with any of the other constructs in the model (Chin, 1998) and should be at least 0.5 (Fornell and Larcker, 1981). Thus our data was acceptable. Table 2 shows the correlation between latent variables while table 3 the average variance extracted. The items in the table correlate to the questionnaire items used in this research; Perceived Ease of Use (PEoU) had four question items, Perceived Usefulness (PU) three question items, Perceived Self-Efficacy (PSE) had four question items, Perceived Credibility (PC) had five question items, Transaction Cost (TC) had three question items, Perceived Normative Pressure (PNP) had five question items, Attitude Toward Adoption (ATA) had five question items while Adoption (A) had two question items. There is high correlation between items on a particular variable compared to the other variables and the square root of AVE was greater than 0.5, therefore the data could be analyzed by factor analysis as depicted by tables 3 and 4.

Table 3: Correlation between Latent Variables

Item	PEoU	PU	PSE	PC	TC	PNP	ATA	A
PEoU1	0.67	0.19	0.18	0.16	0.09	0.08	0.25	0.23
PEoU2	0.69	0.15	0.21	0.16	0.09	0.08	0.22	0.16
PEoU3	0.66	0.14	0.11	0.16	0.15	0.11	0.14	0.13
PEoU4	0.61	0.14	0.01	0.12	0.11	0.04	0.10	0.10
PU1	0.24	0.74	0.15	0.25	0.14	0.23	0.18	0.26
PU2	0.19	0.72	0.16	0.25	0.05	0.14	0.15	0.23
PU3	0.05	0.63	0.22	0.12	0.18	0.12	0.06	0.02
PSE1	0.15	0.15	0.52	0.14	0.02	0.21	0.18	0.24
PSE2	0.14	0.25	0.58	0.19	0.26	0.27	0.19	0.17
PSE3	0.63	0.15	0.54	0.08	0.03	0.01	0.07	0.11
PSE4	0.21	0.15	0.54	0.07	0.03	0.09	0.01	0.03
PC1	0.37	0.10	0.13	0.46	0.13	0.09	0.20	0.15
PC2	0.19	0.20	0.10	0.57	0.02	0.06	0.31	0.26
PC3	0.24	0.25	0.10	0.62	0.13	0.12	0.30	0.27
PC4	0.17	0.23	0.14	0.56	0.08	0.13	0.23	0.20
PC5	0.07	0.26	0.14	0.56	0.11	0.13	0.24	0.22
TC1	0.07	0.08	0.03	0.03	0.71	0.14	0.04	0.10
TC2	0.09	0.10	0.06	0.07	0.71	0.21	0.11	0.05

TC3	0.1 3	0.1 8	0.1 2	0.1 9	0.6 9	0.11	0.18	0.1 1
PNP1	0.0 2	0.1 5	0.2 3	0.0 5	0.0 9	0.66	0.06	0.0 9
PNP2	0.0 5	0.1 6	0.1 6	0.0 9	0.1 6	0.66	0.10	0.1 4
PNP3	0.1 3	0.1 6	0.1 8	0.1 4	0.1 7	0.58	0.16	0.5 1
PNP4	0.1 0	0.2 1	0.0 6	0.1 2	0.1 5	0.58	0.20	0.1 5
PNP5	0.0 9	0.1 1	0.0 7	0.1 4	0.1 2	0.62	0.11	0.2 0
ATA1	0.1 9	0.1 5	0.0 7	0.2 7	0.1 1	0.11	0.58	0.4 4
ATA2	0.1 9	0.1 2	0.1 0	0.2 2	0.1 0	0.11	0.51	0.4 0
ATA3	0.1 3	0.1 0	0.1 3	0.2 6	0.1 6	0.11	0.53	0.3 0
ATA4	0.2 3	0.1 0	0.1 1	0.2 9	0.1 9	0.15	0.50	0.3 6
ATA5	0.1 0	0.0 9	0.0 6	0.2 3	0.0 1	0.15	0.54	0.2 5
A1	0.1 3	0.1 9	0.0 5	0.2 1	0.1 1	0.19	0.37	0.7 9
A2	0.1 4	0.1 5	0.0 9	0.2 2	0.0 6	0.09	0.33	0.7 9

Table 4: Average Variance Extracted

Construct	AVE	Square Root AVE
PEoU	0.5630	0.7503
PU	0.6180	0.7861
PSE	0.3944	0.6280
PC	0.4095	0.6399
TC	0.6235	0.7896
PNP	0.5015	0.7082
ATA	0.3773	0.6142
A	0.7551	0.8689

4.2 Model Validity and Hypotheses Testing

To examine the research model validity and test the hypotheses, we used Analysis of Moment Structures 16 (AMOS 16). This is Structural Equation Modeling (SEM) software that uses Confirmatory Factor Analysis (CFA) to align the tested measures to the specific constructs and constraining the variances of each measure to the latent construct it should represent. In addition to assessing the degree to which each measure contributes to its latent construct, CFA also tests the separation between constructs by evaluating the fit in the overall model.

There are four groups of fit measures. The fit measures within each group give the same rank of ordering of models (Arbuckle, 1995). The first group is Root Mean-Square Error of Approximation (RMSEA) and Tucker-Lewis Index (TLI), the second group is Comparative Fit Index (CFI), the third group is Chi-square, normed chi-square (CMIN) and Normed Fit Index (NFI), and the fourth group is goodness of fit index (GFI), and Adjusted Goodness of Fit Index (AGFI). Among the many measures of fit, four popular measures are: χ^2 /df, GFI, TLI and RMSEA. Figure 3 shows the result obtained when the initial model was fit to the data, the model fit indices obtained are indicated in table 5.

The overall fit for the model is not good with Chi-sq/df being 3.401, at 416 df and is significant and P value 0.00.

Table 5: Fit Indices for the Unmodified Model

Fit Measures	Standards Fit	Model Fit
X2/df	A value close to 1 and not exceeding 3 indicates a good fit.	3.495
IFI	IFI values close to 1 indicate a very good fit.	0.803
TLI	A value close to 1 indicates a very good fit.	0.777
NFI	TLI values close to 1 indicate a very good fit.	0.744
CFI	A value close to 1 indicates a very good fit.	0.801
RFI	RFI values close to 1 indicate a very good fit	0.714
RMSEA	A value should not greater than 0.1	0.080

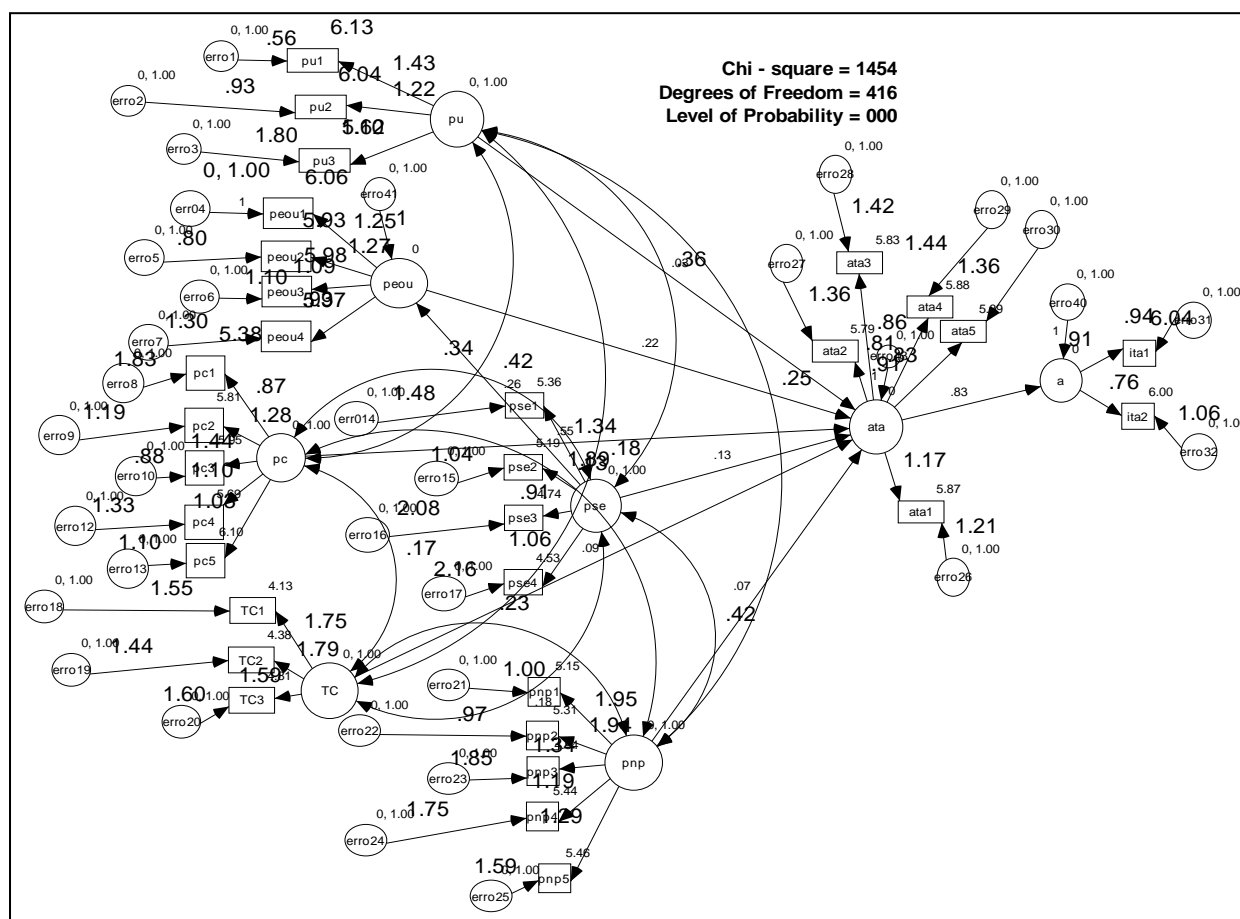


Figure 3: Graphical Representation of the Unmodified Model.

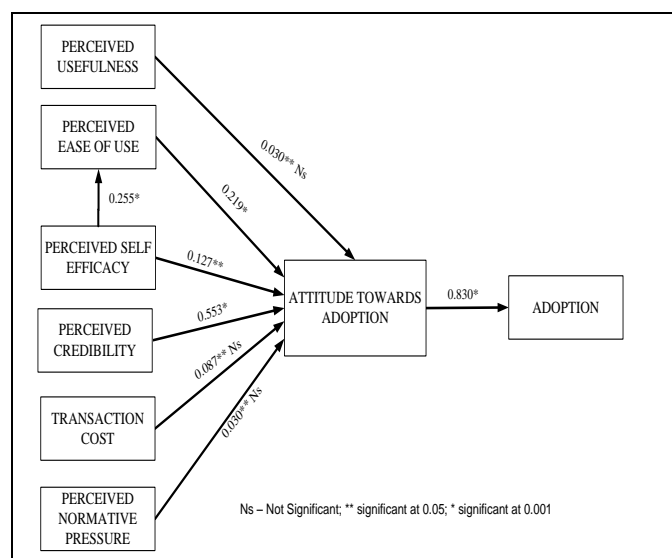


Figure 4: Result of the Hypotheses Test

Hypotheses H1, H3, H4 and H7b were supported in that PEoU, PC had significant positive effect on attitudes toward M-banking. Altogether they account for 35% of the variance in attitude towards M-banking adoption. PC strongly determined the attitude toward M-banking adoption. PSE had significant effect on PEoU with a p value of 4.082. The relationship between PU and attitude towards adoption was insignificant, with a p-value of 0.688, similarly the relationship between attitude towards adoption and PNP was insignificant with p-value of 0.333, TC and attitude towards adoption was insignificant with a p-value of 0.223. This result is consistent with the finding of previous research on M-banking. The one possible explanation could be the lack of knowledge and awareness about M-banking in Kenya since the innovation has not been accepted by many people in Kenya.

Model Modification

AMOS 16 suggests various modifications of a model by carrying out a separate analysis test for each potential modification using modification indices. Modification indices allow one to evaluate many potential modifications in a single analysis. They provide suggestions for model modifications that are likely to pay off in smaller chi-square values. After carrying out the initial analysis, we obtained the modification indices we used to validate the final model for this research. We present the standardized model obtained in this research in Figure 4 while table 7 shows the fit indices for the model. The overall fit for the model is good with Chi-sq/df is 2.704, at 409 df and is significant and P value 0.00.

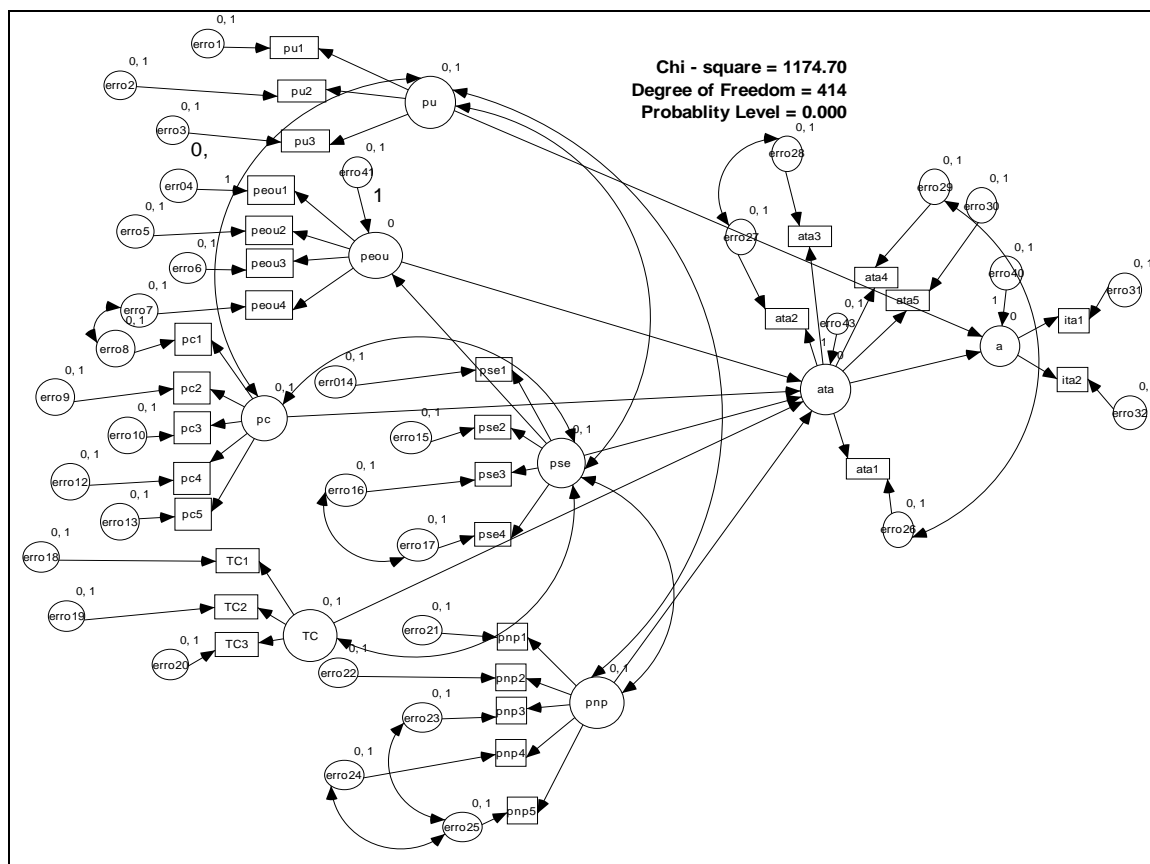


Figure 5: The Standard Modified Model

Table 6: Results of the model goodness of fit

Fit Measures	Standards Fit	Model Fit
2/df	A value close to 1 and not exceeding 3 indicates a good fit.	2.838
IFI	IFI values close to 1 indicate a very good fit.	0.855
TLI	A value close to 1 indicates a very good fit.	0.836
NFI	TLI values close to 1 indicate a very good fit.	0.793
CFI	A value close to 1 indicates a very good fit.	0.854
RFI	RFI values close to 1 indicate a very good fit	0.767
RMSEA	A value should not be greater than 0.1	0.068

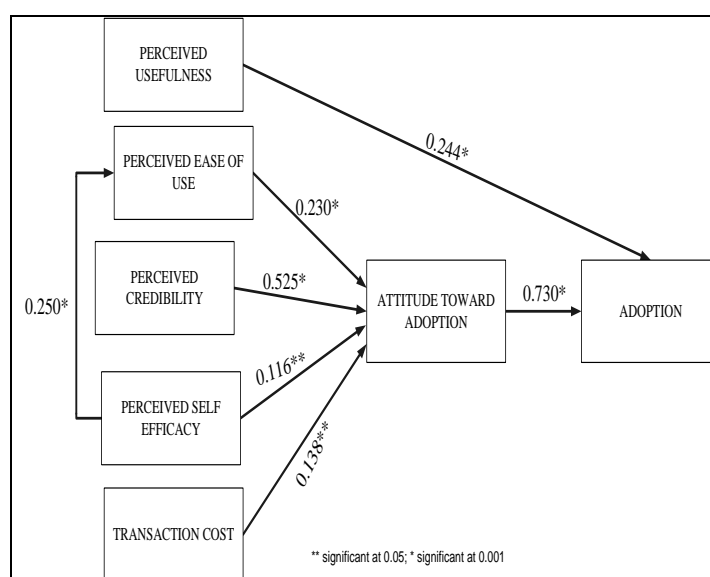


Figure 6: The Proposed Model

5. DISCUSSION AND CONCLUSIONS

The framework presented in Figure 5 has been developed for assessing M-banking adoption in Kenya. This framework has eight constructs that were found to significantly influence the adoption of M-banking services. The framework can be used as a guide when assessing the adoption of an M-banking service. Some of the construct exhibited stronger significance than others. The framework is generic and can be used in any developing country.

The framework presented in Figure 5 has been developed for assessing M-banking adoption in Kenya. This framework has eight constructs that were found to significantly influence the adoption of M-banking services. The framework can be used as a guide when assessing the adoption of an M-banking service. Some of the construct exhibited stronger significance than others. The framework is generic and can be used in any developing country.

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