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# Towards A Comprehensive Framework For Measuring Technology Trust: The Case Of Mobile Banking Adoption In Nigeria

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**ABSTRACT**

Existing literature has led to a consensus among researchers that the presence of user trust in a specific innovation will result in user's increased willingness to adopt that technology. However, there exists a lack of consensus on the specific factors contributing to users trust in a specific technology innovation. This study addresses this lack of consensus by identifying and empirically evaluating a set of antecedents to Nigerians' trust mobile banking technology; using an integrative model. Research was conducted using a questionnaire developed and distributed in Nigeria and out of 2256 returned questionnaires, 1725 were deemed to have been completed and hence usable. The data was analysed using confirmatory factor analysis and the results showed that confidentiality, integrity, authentication, access control, best business practices and non-repudiation significantly influenced technology trust with availability showing unsatisfactory values for consideration. From an academic standpoint, this empirical study provides a validated and consolidated research model can be adopted in future research in related fields of study as well as providing significant information to mobile banking vendors and application developers on the

specific aspects of the technology which must be improved to encourage increased adoption of the technology in Nigeria

## 1. INTRODUCTION: TRUST

The concept of trust has been defined and investigated in several disciplines such as economics, organisational behaviour, psychology and sociology. This is because trust is considered a complex, multi-dimensional construct that can be studied from numerous points of view and applied in various unique contexts [11]. With various fields of study affording definitions for trust, Koo and Wati [17] provide a definition, which considers it from an information technology perspective and adequately describes trust in technology, also called technology trust, and its influence on the adoption of information technology such as mobile banking. The definition describes trust in technology as "an individual's willingness to experience vulnerability to financial institutions and their technology based on their perception of the institution and information technology infrastructure". This definition is particularly significant as it identifies technology trust as a key component which influences users' decision to adopt technology such as mobile banking.

Furthermore, technology trust plays a significant role in mobile banking adoption because as its adoption causes uses to transition from the traditional banking environment, characterised by physical bank branches, face to face interaction between parties participating in a transaction, the exchange of physical cash for goods

and serves, to a mobile cashless environment which excludes the afore mentioned characteristics and replaces them with financial services and transactions which are carried out through mobile telecommunication devices and mobile networks. This unique environment therefore causes users to trust that various information technology infrastructures, such as mobile phones, tablets, mobile telecommunication networks and mobile banking applications will operate reliably and securely and not expose them to vulnerabilities such as breach of privacy or unauthorised access to their funds [18] [27]

With this in mind, it is theoretically deducible that the current low adoption of mobile banking in Nigeria, which was reported to be at 13% in 2013, could be attributed to a lack of trust in the technology. This suggested lack of trust was also highlighted statistically in reports from EFINA [9] which revel lack of trust to be the most influential factor in user's reluctace to adopt cashless banknig technologies like mobile banking.

Figure 1: Reasons for non-adoption of mobile banking in Nigeria [9]
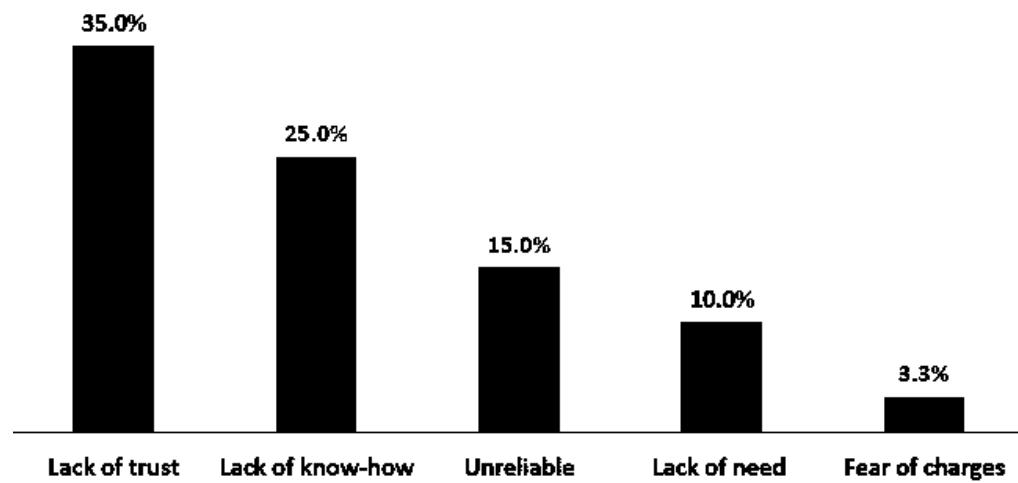
With a lack of trust in the technology emerging as the highest contributing factor to the slow adoption of mobile banking in Nigeria, the premise of this study canters on clearly identifying the contributing factors to technology trust and statistically evaluating their current impact on technology trust in other to both provide a standard framework for investigating technology trust which can be used in future related research as well as reveal which factors significantly influence users decision to trust and adopt mobile banking in Nigeria. To accomplish this, the disparity between exiting research regarding the factors contributing to technology trust were considered and consolidated.

Figure 1 shows that, in comparison to issues discussed by researchers such as Agwu and Carter [2] a variety of other issues were identified from the sample group; with lack of trust emerging as the factor with the highest impact on customer's resistance to mobile banking adoption. This creates the basis of this study as the research aims to use appropriate theories and research frameworks to identify the factors which contributing to user trust in mobile banking technology as well as the level of impact trust, and any other factors, have on mobile banking adoption in Nigeria. In previous sections of this document, a better understanding of mobile banking in Nigeria was achieved by stating the motivations for its introduction in Nigeria, defining the concept of mobile banking, understanding its business and technological evolution, identifying customer adoption trends as well as discussing the policies and challenges the technology faces in Nigeria. All these have provided with a focused outlook on the problem environment and the issues this study aims to address in Nigeria.

## 2. ANTECEDENTS OF TECHNOLOGY TRUST

In the academic field, there exists a lack of consensus regarding the specific factors contribute to technology trust with several researchers stating different factors which

define specific constituting aspects of the concept. Table 1 provides an overview of existing research and the technology trust antecedents postulated respectively

Table 1: Technology trust antecedents in previous research

| Source | Factors |
| --- | --- |
| Bhimani [5] | Privacy, Accuracy, Genuine, Acknowledgment, Unauthorised access, Allows authorised access, Auditing |
| Parker [25] | Privacy, Not being altered, Being true, authorised access, Right to use, High quality standard |
| Jamieson [14] | Protection from unauthorised reading and copying, Completeness, Originality, Non-denial, Protects transmission media, Protection from hackers, Standards, written policies and procedures |
| Zhenhua and Shaobo [29] | Trust in vendors, Structural assurances |
| Masrek et al [20] | Trust in mobile banking websites, Trust in mobile phones Trust in mobile networks |

In an attempt to address the evident disparity in opinions on the antecedents of technology trust, Ratnasingam et al. [26] theorised seven factors which appropriately define technology trust. These seven factors not only consolidated the antecedents used in previous studies but were also centred on the notion suggested by [7] that technology trust and its factors are based on safeguards, protective measures and control mechanics that aim to provide reliable transactions from timely, accuracy and compete data transmissions. The stipulate factors are, Confidentiality, Integrity,

Authentication, Non-repudiation, Access controls, Availability and Best business practices.

Confidentiality refers to privacy issues and determines customer trust based on the mobile banking information technology being able to protect transactions and personal data from unauthorised access, disclosure and manipulation. Integrity refers to mobile banking transaction accuracy, as customers are more likely to exercise trust if all transaction operations are consistently carried out without being distorted. Authentication determines a customer's propensity to trust as it refers to the legitimacy of mobile banking transactions and the perception that all the elements involved in the transaction are genuine. Non-repudiation refers to systems that ensure the parties involved in a transaction cannot deny having participated in the transaction after participating in the transaction. Access control defines the infrastructures set up to ensure transactions are carried out without intrusions and disruptions. Best business practices focuses on the institutional aspects of mobile banking and leads customers to have more confidence in mobile banking based on regulatory infrastructures and operations, which govern mobile banking. Availability refers to customer's willingness to trust based on the regular presence of mobile banking infrastructure as issues such as a weak or absent signal, faulty devices and outright absence of mobile banking service will lead to diminished customer confidence in mobile banking.

The authors adopted these factors as determinants of technology trust not only because of the theoretical suggestions made by existing researchers but also because they coincides with practical issues facing user trust and adoption of mobile banking and other cashless payment systems in Nigeria as well.

Based on these theorised stipulated factors, this study aims to investigate the influence of these seven factors on technology trust itself. Consequently, 7 hypotheses were developed which also form the basis of this study's research model in Figure 2.

- **H1:** Confidentiality significantly contributes to technology trust in mobile banking in Nigeria.

- **H2:** Integrity significantly contributes to technology trust in mobile banking in Nigeria.

- **H3:** Authentication significantly contributes to technology trust in mobile banking in Nigeria.

- **H4:** Availability significantly contributes to technology trust in mobile banking in Nigeria.

- **H5:** Non-repudiation significantly contributes to technology trust in mobile banking in Nigeria.

- **H6:** Best business practices significantly contribute to technology trust in mobile banking in Nigeria.

- **H7:** Access control significantly contributes to technology trust in mobile banking in Nigeria.

Figure 2: Research model
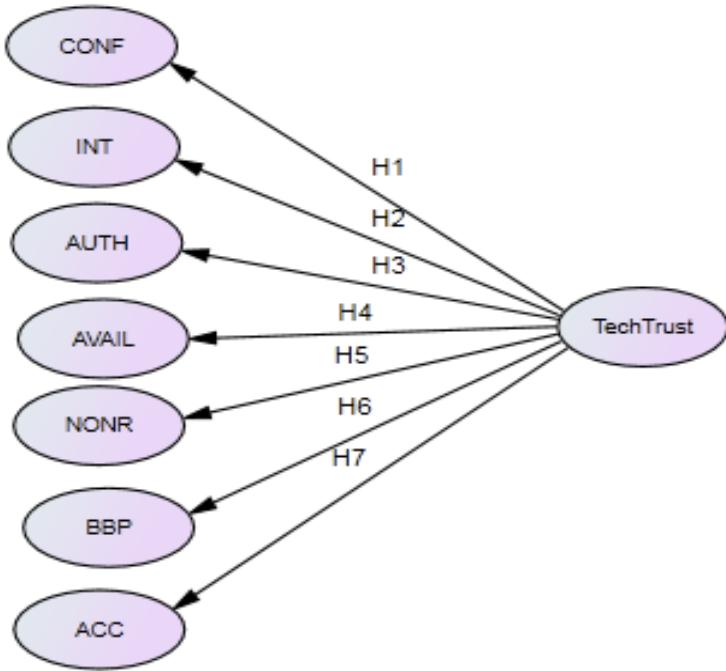


## 3. METHODOLOGY

For the purpose of this study, a quantitative survey was designed to gather data from respondents in Nigeria. The sample area considered during this study was the state of Abuja, the Federal Capital Territory of Nigeria which comprises six local councils namely: Abaji, Gwagwalada, Kuje, Bwari and Kwali. This state is comprised of both rural and urban areas where cashless payment systems such as mobile banking are considered to be experiencing varied levels of adoption and non-adoption. This study took a quantitative approach to data collection and analysis and data was collected using questionnaires, which were distributed to both users and non-users of mobile banking using convenience sampling. The questionnaire was designed with a total of 40 items which captured data for 10 demographic variables, namely Age, Gender,

Education level, Ethnicity, Employment status, Marital status, Technology competence, Mobile phone ownership, Bank account ownership and Mobile banking status the independent variables in the research model, namely: CONF (Confidentiality), INT (Integrity), AUTH (Authentication), ACC (Access control), NONR (Non-repudiation), BBP (Best business practices), AVAIL (Availability), and the survey items were scored on a five-point Likert scale, (1 = strongly disagree; 2 = disagree; 3= neutral; 4 = agree; and 5 = strongly agree) apart from three questions pertaining to respondents actual use of mobile banking which was measured by providing the participants with five options measuring the frequency of their mobile banking usage.

## 4. RESULTS AND ANALYSIS

A total of 1725 respondents participated in the study and the data was gathered and table 2 provides an overview of the demographic distribution of the respondents. A test for common methods bias was also conducted using Haram's single factor method and the test showed a 22.463% of variance which is less than the 50% threshold, indicating a lack of systematic error with the survey instrument, its items and the data collected.

Table 2: Demographic distribution of respondents

| Demographic | | Frequency | Percentage (%) |
|---|---|---|---|
| **Gender** | Male | 805 | 46.7 |
| | Female | 920 | 53.3 |
| **Age** | 18-24 | 750 | 43.5 |
| | 25-34 | 817 | 47.4 |
| | 35-44 | 88 | 5.1 |
| | 45-54 | 28 | 1.6 |
| | 55-64 | 32 | 1.9 |
| | 65-74 | 6 | 0.3 |
| | 75 | 4 | 0.2 |
| **Marital status** | Single | 1113 | 64.5 |
| | In a relationship | 360 | 20.9 |
| | Married | 239 | 13.9 |
| | Divorced | 13 | .8 |
| **Employment status** | Employed for wages | 790 | 45.8 |
| | Self-employed | 230 | 13.3 |
| | Unemployed | 165 | 9.6 |

| | | | |
|---|---|---|---|
| | A homemaker | 22 | 1.3 |
| | A student | 63 | 3.7 |
| | Military | 451 | 26.1 |
| | Retired | 4 | .2 |
| **Educational level** | No schooling completed | 4 | .2 |
| | Nursery school | 3 | .2 |
| | Primary school | 8 | .5 |
| | Secondary school | 71 | 4.1 |
| | Undergraduate | 192 | 11.1 |
| | Master's degree | 100 | 5.8 |
| | Doctorate degree | 13 | .8 |
| | Trade/technical/vocational training | 838 | 48.6 |
| | Professional degree | 381 | 22.1 |
| | Associate degree | 115 | 6.7 |
| **Ethnicity** | Ibo | 445 | 25.8 |
| | Hausa | 123 | 7.1 |
| | Yoruba | 667 | 38.7 |
| | Other | 490 | 28.4 |
| **Technology competence** | Not competent | 35 | 2.0 |
| | Novice | 73 | 4.2 |
| | Competent | 772 | 44.8 |
| | Advanced | 552 | 32.0 |

| | Expert | 293 | 17.0 |
|---|---|---|---|
| **Mobile phone ownership** | Yes, I own a mobile phone | 1,712 | 99.2 |
| | No, I do not own a mobile phone | 13 | .8 |
| **Bank account ownership** | Yes, I own a bank account | 1,711 | 99.2 |
| | No, I do not own a bank account | 14 | .8 |
| **Mobile banking user** | Yes, I use mobile banking | 1,054 | 61.1 |
| | No, I do not use mobile banking | 671 | 38.9 |

## 4.1. DATA ANALYSIS

Considering the research model and hypotheses to be evaluated, Structural Equation Modelling (SEM) was adopted in this current study, as the characteristics of the statistical technique are appropriate for analysis of the models and data presented in this study. The aim of adopting SEM is to explore the relationships between the 7 factors and their scale items as well as the theorised relationships between these factors and, TechTrust (Technology trust) In addition, factor analysis was performed to assess the construct validity of the model and regression analysis was used to analyse the data. Considering this study into technology trust is supported by existing theories , as well as a theoretical model with generated hypotheses, Confirmatory Factor Analysis

(CFA) is considered to be the most appropriate analysis procedure to be used as it is a potent data analysis tool which explicitly allows the authors to validate hypotheses in order to resolve factor analytic problems based on theoretical suggestions. To validate how well the research model fits with the data obtained for analysis, a set of model fit indices will be used as the criteria for evaluating the model's goodness of fit. Table 3 provides a summary of the goodness of fit criteria.

Table 3: Goodness-of-fit criteria

| Model fit criteria | Threshold | Reference |
|---|---|---|
| **Tucker Lewis index (TLI)** | ≥0.90 | Bentler and Bonett, [3] |
| **Comparative fit index (CFI)** | ≥0.90 | Bentler, [4]; Hu and Bentler, [13] |
| **Root mean square error of approximation (RMSEA)** | ≤0.05 | Brown and Cudeck, [6] |
| **Factor loadings** | ≥0.45 | Hair et al, [12] |

## 5. RESULTS

The model was first evaluated at the measurement level. CFA was used to test the entire measurement model to evaluate the relationships between the various latent constructs and their respective indicators as well as the relationship between latent constructs in the model. Table 4 shows the initial model fit values of the model. During the measurement level evaluation, variables that achieved unsatisfactory values, in relation to model fit criteria stipulated were removed from the model to achieve optimal model fit [12]

## 5.1. MEASUREMENT LEVEL EVALUATION

Firstly, ACC26, a scale item measuring ACC, was also removed as it showed a factor loading of -0.280, which is less than the 0.45 cut-off. Its deletion still left two scale items to measure ACC, which is considered acceptable [16].

Secondly, AVAIL29, a scale item measuring AVAIL was removed as the scale item achieved a significance of 0.363, which is above the stipulated cut-off of 0.05.

Finally, upon inspection of AVAIL30, it was observed that the scale item showed a standardised factor loading of 1.73 on AVAIL and the error variance for the scale item was -2.345 with an R-squared value of 4.528. This error variance and R-Squared values explain the occurrence of a factor loading greater than 1 as a negative error variance and R-squared values greater than 1 indicate that the solution are inadmissible and the estimation is improper [21] This resulted in the removal of AVAIL30 from the model and with AVAIL29 removed for achieving unsatisfactory statistical significance, the variable AVAIL was removed entirely from the model, as the variable had no scale items measuring it satisfactorily. However, the authors suggests that the study of availability in relation to technology trust can still be investigated in future research with as McDonald [21] suggests that one solution to addressing a negative variance and unsatisfactory R-squared values is the introduction of additional scale items to measure the unobserved variable.

Subsequent to removing the scale items with unsatisfactory values, the model's goodness of fit was re-estimated. The final overall model achieved a significant chi-square value of 490.313 and 120 degrees of freedom at a probability level of p< 0.001. Table 4 shows the goodness-of-fit values for the final model and Table 5 shows all factor loadings in the measurement level of the model's analysis in addition

to values achieved for composite reliability, Cronbach's alpha and the average

variance extracted.

Table 4: Initial and final model fit indices for model

| Model | TLI | CFI | RMSEA |
|---|---|---|---|
| Criteria | ≥0.90 | ≥0.90 | <0.05 |
| **Initial measurement model** | 0.940 | 0.953 | 0.045 |
| **Final measurement model** | 0.960 | 0.966 | 0.042 |
| Note: RMSEA = Root mean square error of approximation; TLI = Tucker Lewis index; CFI = Comparative fit index. | | | |

Table 5: Measurement level values with composite reliability and average variance extracted

| Construct | Items | $\lambda$ | S.E | $(\Sigma \lambda_i)^2$ | CR | Cronbach's alpha | AVE |
|---|---|---|---|---|---|---|---|
| CONF | CONF13 | 0.809 | 0.32 | 5.392 | 0.827 | 0.815 | 0.602 |
| | CONF12 | 0.809 | 0.28 | | | | |
| | CONF11 | 0.704 | 0.53 | | | | |
| INT | INT16 | 0.643 | 0.39 | 4.260 | 0.782 | 0.729 | 0.476 |
| | INT15 | 0.675 | 0.46 | | | | |
| | INT14 | 0.746 | 0.34 | | | | |
| AUTH | AUTH25 | 0.722 | 0.41 | 2.202 | 0.741 | 0.710 | 0.551 |
| | AUTH24 | 0.762 | 0.36 | | | | |
| NONR | NON19 | 0.743 | 0.33 | 3.709 | 0.728 | 0.650 | 0.419 |
| | NON18 | 0.550 | 1.20 | | | | |

| | | λ | S.E | | CR | | AVE |
|---|---|---|---|---|---|---|---|
| | NON17 | 0.633 | 0.45 | | | | |
| BBP | BBB60 | 0.629 | 0.47 | 6.864 | 0.797 | 0.749 | 0.430 |
| | BBB55 | 0.662 | 0.37 | | | | |
| | BBB36 | 0.681 | 0.46 | | | | |
| | BBB27 | 0.648 | 0.45 | | | | |
| ACC | ACC28 | 0.787 | 0.28 | | 0.776 | 0.725 | 0.571 |
| | | | | 2.283 | | | |
| | ACC27 | 0.724 | 0.38 | | | | |
| Note: λ=Standardised factor loadings; S.E=Error variance; CR= Composite reliability; AVE=Average Variance Extracted. All relationships were significant at p<0.001 | | | | | | | |

From table 4:15, it can be seen that all constructs showed good composite reliability values, above the stipulated 0.7 cut-off mark. Regarding Cronbach's alpha, all constructs showed satisfactory values of 0.7 and above, indicating satisfactory consistency and reliability, apart from NONR (0.65). As Cronbach's alpha is an evaluation of the scale consistency in regards to participant response, the response rate for NONR was therefore viewed as having satisfactory reliability but not satisfactory consistency at the 0.7 level.

## 5.2. STRUCTURAL LEVEL EVALUATION

Following the model's evaluation at the measurement level, the model was tested in the structural level to test this study's hypotheses. In addition, the 10 demographic variables were introduced as covariates to estimate their influence on technology trust. The values in table 6 were achieved and the model showed a chi square of

966.527 and 299 degrees od freedom significant at p<0.001. In addition, Table 7 shows the goodness-of-fit values achieved and the model achieved satisfactory and RMSEA, TLI and CFI values.

Table 6: Structural level factor loadings

| Variable relationships | Unstandardized estimates | Standardised estimates | S.E | P |
|---|---|---|---|---|
| TechTrust ← Gender | -0.028 | -0.025 | 0.028 | 0.319 |
| TechTrust ←Technology | 0.080 | 0.129 | 0.016 | *** |
| TechTrust ← Bank | -0.148 | -0.024 | 0.162 | 0.361 |
| TechTrust ←Ethnicity | 0.022 | 0.046 | 0.012 | 0.061 |
| TechTrust ← Marital | -0.008 | -0.011 | 0.020 | 0.705 |
| TechTrust ← Employment | 0.014 | 0.052 | 0.007 | 0.047 |
| TechTrust ← Education | -0.011 | -0.032 | 0.009 | 0.210 |
| TechTrust ← Phone | -0.055 | -0.009 | 0.167 | 0.740 |
| Techtrust ← Age | -0.021 | -0.033 | 0.019 | 0.273 |

| Variable relationships | Unstandardized estimates | Standardised estimates | S.E | P |
|---|---|---|---|---|
| TechTrust ←Mbanking | -0.385 | -0.340 | 0.032 | *** |
| INT←TechTrust | 1.000 | .901 | | *** |
| NONR←TechTrust | .986 | .728 | .053 | *** |
| BBP← TechTrust | 1.032 | .873 | .054 | *** |
| AUTH← TechTrust | 1.002 | .702 | .057 | *** |
| CONF← TechTrust | 1.231 | .746 | .060 | *** |
| ACC← TechTrust | 1.023 | .743 | .056 | *** |
| INT16←INT | 1.000 | .642 | | *** |
| INT15←INT | 1.184 | .677 | .052 | *** |
| INT14←INT | 1.252 | .745 | .052 | *** |
| NON19←NONR | 1.000 | .745 | | *** |
| NON18←NONR | 1.129 | .549 | .061 | *** |
| NON17←NONR | .862 | .632 | .042 | *** |
| BBB60←BBP | 1.000 | .632 | | *** |
| BBB55← BBP | .972 | .665 | .044 | *** |
| BBB36← BBP | 1.128 | .677 | .051 | *** |
| BBB27← BBP | .922 | .647 | .043 | *** |
| AUTH25←AUTH | 1.000 | .722 | | *** |
| AUTH24←AUTH | 1.052 | .762 | .050 | *** |
| ACC27←ACC | 1.000 | .720 | | *** |

| Variable relationships | Unstandardized estimates | Standardised estimates | S.E | P |
|---|---|---|---|---|
| CONF13←CONF | 1.000 | .809 | | *** |
| CONF12← CONF | .938 | .809 | .029 | *** |
| CONF11← CONF | .926 | .703 | .032 | *** |
| ACC28←ACC | 1.038 | .791 | .045 | *** |
| S.E=Error variance; ***=p<0.001. | | | | |

Table 7: Goodness-of-fit values for structural model

| Model | CFI | TLI | RMSEA |
|---|---|---|---|
| Criteria | ≥0.90 | ≥0.90 | <0.05 |
| Model values | 0.945 | 0.931 | 0.36 |
| RMSEA = Root mean square error of approximation; NFI = Normated fit index; CFI = Comparative fit index. All relationships significant at p<0.001 | | | |

## 5.3. HYPOTHESES EVALUATION

Subsequent to achieving satisfactory model fit values for the structural model, the hypotheses of the study was evaluated based on regression weights, which signify the degree of influence between independent and dependent variables, and p-values, which indicate the level of significance of the relationships. Table 8 below shows a summary of the final regression path coefficients, their corresponding levels of significance, and the related hypotheses.

Table 8: Research hypotheses and remarks based on achieved results

| Hypothesized relationship | | λ | S.E | P | Remark |
|---|---|---|---|---|---|
| **H1** | Confidentiality→Techtrust | .746 | .060 | *** | **Accepted** |
| **H2** | Integrity→Techtrust | .901 | .040 | *** | **Accepted** |
| **H3** | Authentication→Techtrust | .702 | .057 | *** | **Accepted** |
| **H4** | Availability→Techtrust | .200 | .044 | *** | Removed |
| **H5** | Non-repudiation→Techtrust | .728 | .053 | *** | **Accepted** |
| **H6** | Best business practices→Techtrust | .873 | .054 | *** | **Accepted** |
| **H7** | Access control→Techtrust | .743 | .056 | *** | **Accepted** |
| λ=Standardised factor loadings; S.E: Error variance; ***=p<0.001 | | | | | |

## 6. DISCUSSION

In summary, from the validated hypotheses shown in Table 8, the authors are able to answer the following questions:

**What are the significant contributing factors to technology trust in Nigeria and what level of impact do these factors have on technology trust in Nigeria?**

Prior to the statistical analysis of technology trust in this study, its antecedents were suggested in previous works of Jamieson [14], Bhimani [5], Parker [25], Zhenhua and Shaobo [29] and Masrek et al [20]. In this study, the 7 consolidated antecedents suggested by Ratnasingam et al [26] were considered. In evaluating the antecendets, the results of this study show that confidentiality, integrity, non-repudiation, best business practices, authentication and access control all significantly influence mobile users trust in mobile banking technology with corresponding regression weight values of .746, 0.901, 0.728, 0.872, 0.702 and0.743; all strongly significant at p-

values<0.001. Availability was consequently removed at the measurement level due to error variance and R-squared issues. In terms of the hierarchy of influence, the results from table 4:23 shows that integrity has the highest influence on technology trust, followed by best business practices, confidentiality, access control, non-repudiation and authentication

Regarding the level of impact each of the antecedents had on technology trust, integrity emerged as the antecedent with the highest influence on technology trust with a regression weight of 0.901. Considering that the definition of integrity, provided in chapter two, focuses on transaction accuracy and operation consistency, this result supports the proposition that both users and non-users consider integrity as a paramount criterion towards establishing trust in mobile banking in Nigeria [28]. Agwu and Carter [2] and Odunmeru [24] highlighted a lack of data integrity and transaction reliability as one of the issues facing the cashless policy and its technologies in Nigeria. Reports published by EFINA [9], also show that unreliability is one of the top five issues Nigerians face with the cashless policy. Using this study's theoretical model and SEM statistical techniques, this study provides insight into the level of significance of integrity's influence on user trust in mobile banking as well as the degree of influence in comparison to the other seven factors hypothesised by existing scholars. The results from this research also provide empirical evidence showing that integrity's positive relationship with technology trust in mobile banking means an increase in the integrity of mobile banking technology will lead to an increase in user trust in the technology. Mobile banking provides an advantageous cashless transaction platform for users and the accuracy of the transactions, consistency of operations and reliability of its data are determinants of user's trust and adoption intention. Essentially, if mobile banking fails to be perceived by the

customers as an innovation with satisfactory levels of integrity then users' trust in the technology will decline; consequently leading to a decline in adoption as well.

The second-most influential factor on users trust in mobile banking technology was best business practices, with a strongly significant factor loading of 0.872 at $p<0.001$ on technology trust. Similar to the results achieved with integrity, this result supports part of hypothesis H6 and provides empirical evidence to theoretical assumptions made by Ratnasingam et al [26].The identification of best business practices as a significant influential factor in users' trust in mobile banking technology holds true both in the results of this study as well as in the real-world mobile banking environment.  Both CBN [8], and EFINA [9] highlighted poor complaint resolution, customer care and business practices as factors deterring users from adopting cashless technologies like mobile banking. The results from this study's cross-sectional examination of both users and non-users of mobile banking suggest that users are more likely to trust in mobile banking technology if appropriate policies and customer services practices are established.

When considered from an alternative point of view, best-business practices is conceptually similar to organisational trust, a dimension of trust discussed in chapter two. Similar to this study's appraisal of best business practices, Mcknight et al, [22] and Keen et al. [15] definition of organisational trust consider the concept to be a dimension of trust which is dependent on legal frameworks, adequate policies and good customer care, as prerequisites to increasing user trust in technology. Considering the similarities between these scholars' definition of organisational trust and this study's evaluation of best business practices, the authors proposes the

existence of a relationship between organisational trust and technology trust. This proposition is evidenced by the results achieved in this study as well conclusions made by Zhou [30], Maroofi et al [19] and Zhenhuen and Shaobo [29] which state that users will not trust or adopt mobile banking technology if there are unsatisfactory legal and technological guidelines and business practices governing the use of the technology. The research considers this theorised relationship, drawn from the results of this study, as a catalyst for future investigations into the existence of a relationship between organisation trust and technology trust.

Confidentiality and access control come in as the third and fourth most-significant influential factor in users' trust in mobile banking technology. The results achieved for both factors lend support to the hypotheses H1 and H7 and highlight
the continued importance of user privacy in technology adoption with both factors showing strongly significant p-values at $p<0.001$ and factor loadings of 0.746 and 0.743 respectively. Despite existing in the third and fourth position of influence on technology trust, the authors highlight the identical statistical significance and minute difference in regression weight values as evidence that both confidentiality and access control are equally important factors in determining technology trust. Consider the definitions of both constructs presented in chapter two, confidentiality refers to user privacy issues, financial data protection and prevention of unauthorised access, disclosure or manipulation. Access control focuses on the infrastructures established to ensure only authorised access to personal data [26]. In essence, the authors consider confidentiality as the concept of privacy protection, while access controls are the measures ensuring confidentiality. In Nigeria's online banking environment, the issue of e-fraud has been a prevalent problem affecting cashless banking channels like internet and mobile banking [8], e-fraud had already been reported by CBN [8] to

have cost the Nigerian economy over N160 billion in losses between the year 2000 and 2008. Odunmeru [24] and Agwu and Carter [2] also theorised that online crimes and security issues as major problems facing mobile banking payment systems; resulting in lower trust and confidence in the technology. The results from this study provide empirical evidence to these assertions by going beyond theoretical assumptions and providing concrete statistical evidence of the role privacy and privacy control issues play in technology trust and mobile ultimately banking adoption. The results show that an increase in measures that ensure confidentiality of customer details will directly increase users' trust in the technology. In the same vein, a lack of assured confidentiality and appropriate access control infrastructures will result in increased reluctance to adopt the technology. In addition, by proposing a parity between the influence of confidentiality and access control, this study also provides a unique contribution to existing literature by suggesting that increased access control is in tandem with increased confidentiality. This indicates that if measures are put into place to ensure the user personal information are protected from unwanted access, manipulation and distribution, then confidentially has been established as well. Bear in mind that the reverse is also the case in this situation, as a lack of access control frameworks will also result in a lack of protection of users' personal information

Based on the results of this study, the fifth and sixth significant factors to influence technology trust are non-repudiation and authentication respectively. These constructs, represented by the variable NONR and AUTH, both achieved strongly significant p-values at $p < 0.001$ and satisfactory factor loadings of 0.728 and 0.702 on technology trust (TechTrust). The results show that, in addition to data integrity, best business practices, confidentiality and access control measures, users also consider

the non-denial of transaction participation and the verification of transaction party's identity as factors influencing their trust mobile banking in Nigeria. In understanding the role of non-repudiation in mobile banking trust and adoption, consider the statement by Garrett and Skevington [10] who suggest that all forms of transactions carried out electronically, from a phone, personal computer or mobile phone, must have adequate measures ensuring authentication, non-repudiation, confidentiality and trust. The revealed significant influences here, as well as its support for hypotheses H5 and H3, suggest that the results are theoretically and empirically accurate. Principally, completed transactions must provide forms of confirmations, such as receipts or confirmatory emails and text messages, which stand as evidence that both parties were intentionally participating in the transfer of funds or exchange of goods and services for payment [1] In satisfying this non-repudiation requirement, the process has also accomplished authentication by legitimising the transaction for both parties and guaranteeing both parties that the participants involved are genuine. Essentially, in order to achieve authenticity, non-repudiation must be established. The authors indicates the results of this study as an additional contribution to knowledge which suggests that despite authors such as Jamieson [14], Bhimani [5] and Parker [25] stating that non-repudiation and authentication are two independent constructs, consideration should be given to the notion that authentication is a by-product of non-repudiation. In understanding their relationship with trust, the establishment of non-repudiation and authentication assures both parties involved in a transaction that the other party will not be able to reject the transaction and cause a dispute based on the pretext that they were not involved in the transaction. The evidence provided to both parties by the payment system not only establishes trust between both parties but also between the parties and the cashless payment system utilised. In summary, if mobile

banking ensures authentication and non-repudiation, customers will be more likely to trust and adopt the technology.

The sixth factor hypothesised to influence technology trust in hypotheses H4 was availability. However, during the course of this study's evaluation of availability's relationship with technology trust as a contributing factor, availability achieved unsatisfactory values for error variance and R-squared. Consequently, availability, represented by the variable AVAIL, was removed from the measurement model and not considered in this study's theoretical assessment as a factor adequately influencing users trust in mobile banking technology in Nigeria. In Masrek et al's [20] research into mobile banking trust in Malaysia, the research model accounted for mobile network trust as a factor affecting technology trust and was measured by the availability of the mobile banking services to consumer's as well as the reliability of the service. Availability was also considered in Zhou's [30] research in China and though it was referred to as ubiquity, it also focused on the availability of the service and its impact on user trust. Both mobile network trust and ubiquity are factors from previous research which are one and the same with the availability factor in this study and the findings in those studies show that availability of the mobile banking service improves its perceived reliability among consumer's and increases their willingness to trust in the service because it is consistent. Theoretically, the influence of availability on technology trust is still plausible in Nigeria as availability issues have constantly been a barrier hindering technology usage and adoption in Nigeria [23]. Therefore, issues such as a weak or absent signal, faulty devices and lack of power supply to support the operation of technology infrastructure are considered as constraints hindering mobile banking availability and technology trust. CBN [8], Odunmeru [24],

Agwu, and Carter [2] had theorised that availability of cashless payment systems was one of the major factors hindering mobile banking technology adoption with Nigeria's lack of constant power supply being a major contributor to the availability issues in the country. In addition, Nwankwo & Eze [23] also considered availability as a major barrier affecting the adoption of cashless banking systems by stating that the current power supply challenges in Nigeria have led customers to feel frustrated with online banking services as power outages at banks result in decreased operation times and even absolute disruption in services. These reports have led to the theoretical assumption that availability would be a major determinant of users' propensity to trust mobile banking technology. Despite the rejection of its hypothesised influence on technology trust, the authors suggest that availability still be theoretically considered in future studies as an antecedent of technology trust.

It is also necessary to note that among all the demographic variables which were introduced as covariates in the model, only mobile banking status, technology competence and employment level showed significant influences on technology trust.. Specifically, technology competence and employment level showed a positive influence on technology trust with significance levels of $p<0.001$ and $p<0.05$ respectively. This indicates that an increase in technology competence or employment level results in an increase in trust in mobile banking technology in Nigeria. In contrast, mobile banking status showed a statistically significant negative impact in technology trust at $p<0.001$. This indicates that when there is an increase in the use of mobile banking, user's trust in the technology diminishes. This results provides a statistical explanation to the current low adoption rate of the technology in the country as well as the lack of trust in the technology

## 7. CONCLUSION

This research attempts to build a comprehensive framework for measuring technology trust by considering confidentiality, integrity, authentication, Non-repudiation, Access control, Best business practices and Availability as theoretical antecedents of technology trust and statistically evaluating their influence on technology trust. To accomplish this, the study considered the role these antecedents play in user's trust in mobile banking technology in Nigeria. The results of this study led in to both academic and practical implications.

Academically, the research model used in this tested contributes this existing knowledge on user adoption tendencies by proposing a framework for technology trust which can be considered in future research and applied with the aim of specifically understanding the factors which contribute to users' trust, not just in mobile banking, but any other technology innovations as well. This study also takes further steps in reconciling the disparity among researchers regarding the antecedents of technology trust by proposing the use of these seven factors as standard variables for investigating user trust in technology.

In terms of practical implications, Nigeria's traditional cash-heavy financial system has been disadvantageous to the nation [8], causing financial institutions and policy makers to seek alternative methods of banking which can alleviate the problems a cash-heavy economy poses towards economic and national development. In deliberating on possible solutions to the cash-heavy problems of the nation, CBN has considered the widespread usage of mobile phones as an opportunity to exploit an already established mobile technology user base, of significant proportions, to

introduce mobile banking as an instrument that offers enough benefits to encourage Nigerians to transition from cash-heavy transactions to cashless transactions. However, adoption levels of the technology are currently unsatisfactory and with financial institutions investing resources in the development and distribution of mobile banking services, understanding the reasons behind the current user adoption trend towards mobile banking will allow policy makers and financial institutions to focus on priority areas to improve user adoption of mobile banking in Nigeria. With this in mind, technology trust was identified as a significant theoretical factor that determines intention to adopt the technology. Integrity was revealed as the most influential factor in determining technology trust followed by best business practices, confidentiality, access control, non-repudiation and authentication. These findings are significant to policy makers and mobile ban king application developers because they indicate that user's adoption of mobile banking can be increased by increasing their trust in the technology. To accomplish this, policy makers and application developers must recognise the establishment and maintenance of mobile banking integrity as a priority for mobile banking application development. Mobile banking reliability, and transaction accuracy should be foremost on the design requirements of the application. Once vendors can ensure that mobile banking services operate reliably and accurately, vendors must then consider their customer care procedures and the methods they use in handling customer complaints and enquiries regarding mobile banking usage. The results from this study show that best business practices is the second most influential factor on users trust in mobile banking technology in Nigeria. Users will be more likely to trust and adopt the technology if it operates reliable and their complaints can be addressed by vendors in circumstances when it does not operate reliably. Subsequent to establishing an application that operates reliably as

well as establishing satisfactory business practices, customer privacy protection and access control must be guaranteed. Adequate security measures must be in place to ensure that user financial information is safeguarded from unauthorised access and manipulation. Upon reaching satisfactory integrity and confidentiality measures, non-repudiation and authentication are the next priority. Vendors must then consider that users require assurances that participants involved in transactions are genuine and will not be able to deny participating in a transaction after actually participating. Ensuring that only valid and authenticated users participate in transactions increases users trust in the technology and ultimately their adoption of mobile banking. In light of these suggestions, the research would also like to note despite integrity showing higher degree of influence on technology trust, it does not indicate that all other influential factors should be considered with less priority. Instead, the authors suggests that policy makers ensure that even when considering integrity as a priority because of its higher degree of influence on technology trust, confidentiality, best business practices and the other influential factors should be given adequate focus as well in order to create optimal mobile banking solutions. These suggestions can be addressed technologically as well as managerially by certifying that the design of mobile banking software meets appropriate standards for all six factors and guaranteeing that policy makers provide adequate support and impetuses to designers to meet these standards. By adhering to all this, trust in mobile banking technology and the adoption of the technology will increase. It is necessary to note that this study was limited by geographical and socio-political constraints in Nigeria.

Considering the current threat of terrorist activity in Nigeria, several areas were unable to be considered as part of the sample group. However, the author still considers the data, which can be obtained from these areas as significant to mobile

banking adoption studies as the population in these areas are both users and non-users of the technology. Therefore the authors recommend future studies to consider obtaining data from this area providing that safety can be assured by either increased security measures or the improvement in the socio-political issues in Nigeria.

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