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**Koloseni, Daniel Ntabagi**

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# User Perceptions of Mobile Banking Apps in Tanzania: Impact of Information Systems (IS) Factors and Customer Personality Traits

**Daniel Ntabagi Koloseni**
*Lecturer, Faculty of Computing, Information Systems and Mathematics, Institute of Finance Management, Dar es Salaam*
https://orcid.org/0000-0002-4104-2704

**Abstract**
This study probes the roles that information systems (IS) success factors and user personality traits play in Tanzanian users' perceptions of their experiences with mobile banking apps. Based on a survey of 249 mobile banking customers, the study finds that users are being positively influenced by the apps' *system quality* and *system service*, but not by the apps' *information quality*. The study also finds that, with respect to user personality traits, *openness*, *agreeableness*, *conscientiousness* and *extraversion* are all traits that have a positive impact on customers' use of, and satisfaction with, mobile banking apps. The findings suggest that developers of mobile banking apps for the Tanzanian market need to both improve the quality of the information in the apps and continue to target a range of personality traits.

**Keywords**
mobile banking apps, adoption, personality traits, information systems (IS), IS success model, Tanzania

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## 1. Introduction

Banks and financial institutions are investing heavily in the development of mobile applications (apps) to enhance their mobile banking service provision capacity. Mobile banking apps allow customers to use mobile devices (e.g., a smartphone or a tablet) to make money transfers within banks, across banks, and to/from mobile money platforms (e.g., M-Pesa and Tigo Pesa in Tanzania); to make in-app purchases; and to view balances and bank statements.

The mobile app provides a scalable platform for the provision of banking services and also serves as an advertisement platform through which banks can advertise their services and products. With mobile apps, banks can tailor their services based on the personal needs and/or locations of customers to retain them (Floh & Treiblmaier, 2006). Furthermore, mobile apps enable banks to reduce operational costs by changing the traditional service model to one of self-service, which also enhances customer engagement.

Mobile apps are mostly accessed via smartphones, and thus the proliferation of mobile apps has gone hand in hand with the exponential growth in smartphone usage. However, the use of mobile banking apps can be hampered by several factors, including security, privacy, reliability, information quality, e-services quality, and design issues such as response speed linked to sensor capabilities and small screens (Dukic et al., 2015; Fife & Orjuela, 2012; Gilbert et al., 2011; Godwin-Jones, 2011; Inukollu et al., 2014; Jain & Shanbhag, 2012; Zwass, 2003).

Furthermore, the use of mobile banking apps is affected by the personal characteristics of the user (Barnett et al., 2014; Bennett & Perrewé, 2002), as those personal characteristics interact with an app's system characteristics (Hong et al., 2002; Pituch & Lee, 2006; Ramayah et al., 2012). Because of the growing importance of user personal characteristics in the functioning of technologies, Bennett and Perrewé (2002) suggest incorporating personality traits into research frameworks to better understand technology adoption behaviour, specifically technology usage. There have been numerous studies of the adoption of mobile apps (see Alavi & Ahuja, 2016; Chmielarz & Łuczak, 2015; Hepola et al., 2016; Kumar et al., 2018; Manuel & Veríssimo, 2016; Muñoz-Leiva et al., 2017; Sampaio et al., 2017; Sangar & Rastari, 2015; Vedadi & Warkentin, 2016; Yang, 2013). However, these studies have not given significant attention to the potential roles played by personality traits in the use of mobile banking apps, creating a knowledge gap for banks and their app developers.

Accordingly, the purpose of this study was to investigate the roles played by information systems (IS) factors and customers' personality traits in influencing customers' perceptions of the use of mobile banking apps in Tanzania. The study's data, generated via a survey questionnaire completed by Tanzanian mobile banking users, was

analysed using the DeLone and McLean (2003) IS success model and the five factor model (FFM) of personality (Digman, 1990).

## 2. Context: Use of mobile banking apps

The Tanzanian financial services industry is growing exponentially(Were et al., 2021), triggering an increased need for easy, reliable, timely, and trustworthy access to financial services. To cope with this need, banks in Tanzania are, among other approaches, deploying mobile banking apps. The goal of such apps is to imitate the functions that are carried out by web-based mobile banking applications and make them accessible in a mobile setting, in an interactive and personalised manner, on a smartphone or tablet. Furthermore, mobile banking apps are used to enhance service reachability, position brands in the highly competitive market, and encourage impulse-buying behaviour among consumers (Alavi & Ahuja, 2016). Mobile banking apps add a new set of tools for marketing in the digital age (Alavi & Ahuja, 2016). The owners of the apps (i.e., banks) can easily map consumers' preferences and easily plan how best to meet consumers' preferences through personalised services and suggestions.

Recently, the functionality of mobile payment apps in Tanzania was extended through the integration of quick response (QR) codes. This integration allows customers to scan merchants' QR codes and make payments in real-time (ClickPesa, 2019). It is now common for QR codes, along with other mobile payment channels, to be made available by merchants in major stores in Tanzania. Therefore, due to the benefits offered by mobile financial apps, it is no surprise that banks are heavily and rapidly investing in using mobile apps to deliver selected banking services.

Meanwhile, user adoption of mobile banking apps is rapidly increasing. Several factors have been found to contribute to the adoption of such apps. For instance, Hepola et al. (2016) and Sampaio et al. (2017) find that cognitive processing, activation, perceived risks, and affection have a positive influence on the adoption of mobile banking apps, while Muñoz-Leiva et al. (2017) find that attitude is a strong predictor of intention to use mobile banking apps. Satisfaction and perceived usefulness (performance expectancy) have also featured in several studies as key predictors of the adoption of mobile banking apps, such as the studies by Vedadi and Warkentin (2016), Kumar et al. (2018) and Ahuja and Alavi (2016). Other factors found to influence the adoption of mobile banking apps are intrinsic regulation, identified regulation, external regulation and integrated regulation, perceived ease of use, perceived risk and cost, and need for information (Ahuja & Alavi, 2016; Kumar et al., 2018). Prominent theories used in previous studies investigating the adoption of mobile banking apps include the technology acceptance model (TAM) (Muñoz-Leiva et al., 2017), the expectation–confirmation theory (ECT) (Vedadi & Warkentin, 2016), the self-determination theory (Kumar et al., 2018), and service-dominant logic (Hepola et al., 2016).

## 3. Hypothesis development and research framework

***IS success model***

For measuring users' perceptions of the success or effectiveness of an information system, the DeLone and McLean (2003) IS success model is one of the dominant models. However, as seen in the previous section of this article, the IS success model is not prominent in published studies of the adoption of mobile banking apps. The model focuses on how three quality measures—*system quality*, *service quality*, and *information quality*—interact with system *use* (or *intention to use*) and *user satisfaction* in ways that, if the influences are positive, will generate *net benefits* for the user (DeLone & McLean, 2003).

Previous studies, such as those by Barnett et al. (2014), Camadan et al. (2018), Devaraj et al. (2008), Krishnan et al. (2010), McElroy et al. (2007), Panda and Jain (2018) and Svendsen et al. (2013), have already examined the influence of personal characteristics on technology use in various contexts. However, studies of the influence of personality elements on technology adoption through the lens of the DeLone and McLean (2003) information systems (IS) success model are limited, thus presenting another knowledge gap that this study seeks to address.

Relationships between the IS success model's three quality measures and *use* have been empirically validated in previous studies. For example, Mohammadi (2015) finds that all three quality measures influence the use of e-learning; and Rana et al. (2015) find that the three quality measures influence the use of online public grievance redress systems. Accordingly, for this study, it was expected that each of the three quality measures would influence the use of the mobile banking app. Hence, the following hypotheses were tested:

> **H1**: System quality has a positive influence on the use of mobile banking apps.
> **H2**: Service quality has a positive influence on the use of mobile banking apps.
> **H3**: Information quality has a positive influence on the use of mobile banking apps.

Relationships between the IS success model's three quality measures and *user satisfaction* are also well-documented in previous studies, including the aforementioned

Mohammadi (2015) and Rana et al. (2015) studies, and in the work of Freeze et al. (2019) and Gao and Park (2017). In connection with the above findings, the following hypotheses emerged:

> **H4**: System quality has a positive influence on user satisfaction with mobile banking apps.
> **H5**: Service quality has a positive influence on user satisfaction with mobile banking apps.
> **H6**: Information quality has a positive influence on user satisfaction with mobile banking apps.

Furthermore, the consequent effects of both actual use and user satisfaction could ultimately impact user individual performance based on the net benefits of using mobile banking apps. The user could continue using the mobile banking app if the net benefits are positive or, in other words, if the mobile banking app continues to help the customer or user to achieve individual performance.

User satisfaction is defined as a sum of feelings or an affective response regarding the effectiveness of a particular technology to accomplish a given task (Gatian, 1994; Melone, 1990). In the context of this study, user satisfaction is achieved if the user feels that the mobile banking apps have effectively helped him or her to accomplish banking-related tasks. The relationship between user satisfaction and individual performance is also demonstrated in previous studies such as those of Gelderman (1998) and Isaac et al. (2017). The influence of a user's actual use of information systems on individual performance is reported in studies such as Tam and Oliveira (2016). Furthermore, literature strikes a close relationship between perceived user satisfaction and actual use of information systems or ICT in general. It has been demonstrated that as the perceived satisfaction of using information systems increases, the desire to use mobile banking apps could also shoot up. Examples of empirical findings demonstrating this relationship include those generated by AL Athmay et al. (2016) and Byun and Finnie (2011). Based on the findings of previous studies, the following hypotheses were developed:

> **H7**: User satisfaction with mobile banking apps has a positive influence on individual performance.
> **H8**: Use of the mobile banking apps has a positive influence on individual performance.
> **H9**: User satisfaction with mobile banking apps has a positive influence on the use of the apps.

***The five-factor model***

Personality characteristics refer to cognitive behaviour patterns in facets of general tendencies that govern an individual's thoughts, feelings, and actions (Krishnan et al., 2010; Maddi, 1996). These personality traits play an important role in IS adoption as they affect how information systems are used (Halko & Kientz, 2010; Rosen & Kluemper, 2008). There are many personal characteristics in the psychology literature, however, the current study investigates the direct effects of the "big five" personality traits on the use of mobile banking apps. These five traits are: *conscientiousness*, *openness*, *extraversion*, *neuroticism*, and *agreeableness* (taken from Digman, 1990). Previous studies suggest that the five-factor model (FFM) is effective in explorations of the effects of personal characteristics, with a good predictive ability (Chang et al., 2012). The influence of the big five personality traits has been rarely studied in the mobile banking apps context, despite their potential importance in understanding differences in user behaviour.

*Conscientiousness* encompasses an individual's predisposition to be cautious, organised, hardworking, abiding by rules, and reliable. Thus, conscientious individuals organise themselves to perform tasks with a high level of discipline, and do so cautiously and reliably. Since this group of individuals is self-disciplined, cautious and reliable, they are likely to use mobile banking apps productively to perform banking-related tasks. The empirical finding also indicates that conscientiousness influences the productive use of internet resources (Landers & Lounsbury, 2006) and IT system usage (Barnett et al., 2014). Therefore, the resulting hypothesis was:

> **H10**: Conscientiousness has a positive influence on the use of mobile banking apps.

*Openness* includes an individual's inquisitiveness, willingness to experiment, and inclination to engage and to explore new ideas and the surrounding world (McCrae, 1993; McCrae & Terracciano, 2005). These individuals are likely to try new technology in pursuit of a better way to accomplish the tasks at hand. Similarly, it is expected that open-minded individuals are likely to use mobile banking apps in an attempt to explore the bank-related functions and services offered through mobile banking apps. The association between an individual's openness and eagerness to use technology is reported in various IS studies such as Tuten and Bosnjak (2001) and Kim and Jeong (2015). Hence, consistent with such previous studies, it was hypothesised that:

> **H11**: Openness has a positive influence on the use of mobile banking apps.

*Extraversion* refers to individuals who are social, affectionate, cheerful, and optimistic. They easily get themselves involved in seeking affiliation in the social environment in a quest to achieve a particular goal. Hence, they are more likely to use technology that will help them to achieve goals (Shambare, 2013). For this reason, extroverts are likely to use mobile banking apps to achieve socially related goals. The connection between extraversion and technology use is well reported in the works of Loiacono (2015) and Leonidas et al. (2019). Therefore, it was hypothesised that:

> **H12**: Extraversion has a positive influence on the use of mobile banking apps.

*Neuroticism* reflects emotional instability, negativity, sadness, and difficulty with dealing with all sorts of stress. Since neurotic individuals are inclined to negative perceptions and emotional instability, they tend to perceive technology as stressful and difficult to use, and as a result they tend to avoid and oppose using it (Rosen & Kluemper, 2008). Similar findings which support the relationship between neuroticism and information systems usage include those of Loiacono (2015) and Barnett et al. (2014). Hence, it was hypothesised that:

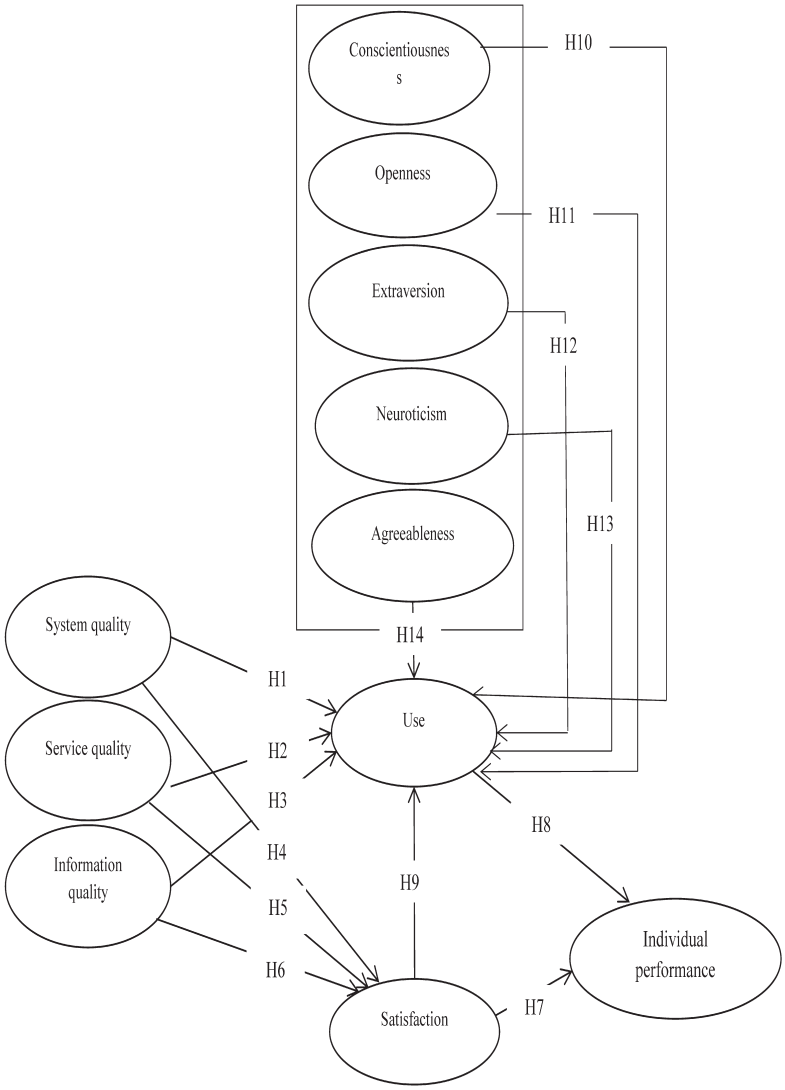
> **H13**: Neuroticism has a negative influence on the use of mobile banking apps.

*Agreeableness* embodies the tendency of individuals to be compassionate, tolerant, good-natured, forgiving, and cooperative. IS literature indicates that agreeableness is positively linked to technology use. It has been found that agreeable individuals patiently use technology that is slightly difficult to use, such as a website that is onerous to navigate (Landers & Lounsbury, 2006). Loiacono (2015) reports that agreeable people are more likely to use the internet and social networking sites. Accordingly, it was hypothesised that:

> **H14**: Agreeableness has a positive influence on the use of mobile banking apps.

The research framework for the study, based on the 14 hypotheses, is illustrated in Figure 1.

**Figure 1: Research framework**



## 4. Methodology

### *Instrument development*

The data collection questionnaire had two parts. The first part consisted of items for measuring respondent perceptions of the use of mobile banking apps, and the second part consisted of items aimed at gathering demographic information. Items on the perceptions of respondents (see Appendix) were borrowed from previous studies and adjusted to match the setting of this study. Items for measuring user perceptions of system quality, service quality, information quality and use were based on those used by Urbach et al. (2010); items for measuring a user's performance were based on those used by Goodhue and Thompson (1995); items for measuring user satisfaction were based on those used by Bhattacherjee (2001), and items for measuring conscientiousness, openness, agreeableness, extraversion, and neuroticism were based on those used by Donnellan et al. (2006) and Goldberg (1999).

All the items for measuring respondent perceptions consisted of statements (see Appendix), each of which respondents rated via a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). Prior to its use with respondents, the questionnaire was sent to five information system experts and five experienced banking services personnel to check content validity. The comments provided by these individuals informed the finalisation of the questionnaire.

### *Study sample, data collection*

The study sample consisted of Tanzanian users of mobile banking apps from five regions: Dar es Salaam, Arusha, Mwanza, Dodoma, and Kilimanjaro. These regions host the majority of the country's bank branches. A judgmental sampling method was employed during the selection of respondents. Respondents were selected based on two criteria: (1) experience of using mobile banking apps for six months or more; and (2) habit of using mobile banking apps at least once per week.

The population of respondents who met the selection criteria for this study is large and unknown. In this situation, it is recommended that the Cochran formula for the unknown population be applied to determine the appropriate sample size for the study (Cochran, 1977). Using the Cochran formula, $n_0 = Z^2 p(1-p)/e^2$ $n_0 = Z^2 p(1-p)/e^2$ (where $Z$ is the confidence level, $p$ = expected proportion, and $e$ = margin error), the sample size of the study was 384 respondents. This study set $Z$ = 1.96 at 95% confidence level, margin error in a proportion of one, if 5%, $e$ = 0.05 and expected proportion in a proportion of one, $p$ = 0.5.

The questionnaire was self-administered to the targeted respondents. Out of 384 questionnaires, 249 questionnaires were completed. Before data analysis, the collected questionnaires were checked for missing data using the missing completely at random (MCAR) test (Little, 1988). The test result was not significant ($x^2 = 178.733$, $df = 160$, $p = 0.148$), indicating that there were randomly missing data. Missing data were replaced by estimating maximum likelihood using the expectation-maximisation (EM) approach.

## 5. Results

### *Descriptive findings*

Table 1 provides demographic information—gender, age, years of experience using mobile banking apps, and frequency per week of use of the apps—for the 249 respondents.

**Table 1: Respondent demographics ($N = 249$)**

| Variable | Category | Frequency | Percentage |
|---|---|---|---|
| Gender | Male | 172 | 69.1 |
| | Female | 77 | 30.9 |
| Age | 18–25 | 72 | 28.9 |
| | 26–45 | 116 | 46.5 |
| | 46 or older | 61 | 24.5 |
| Years of experience using mobile banking apps | less than 1 year | 62 | 24.9 |
| | 1–3 years | 68 | 27.3 |
| | more than 3 years | 119 | 47.8 |
| Frequency per week of use of mobile banking apps | 1–3 times | 37 | 14.9 |
| | 4–6 times | 72 | 28.9 |
| | 7–9 times | 64 | 25.7 |
| | more than 10 times | 76 | 30.5 |

### *Assessment of the measurement and structural models*

The study used covariance-based structural equation modelling (CB-SEM) to assess both the measurement model and the structural model. The study followed a two-stage approach, as recommended by Anderson and Gerbing (1988): (1) assessment of the measurement model; and (2) assessment of the structural model.

*Assessment of the measurement model*

To assess the measurement model, the study used model fit indices from each category of model fit indices as defined by Hair et al. (2010). Specifically, the study used Root Mean Square of Error Approximation (RAMSEA) and Goodness of Fit Index (GFI) from the absolute fit category, Comparative Fit Index (CFI) and Tucker-Lewis index (TLI) from the incremental fit category, and $x^2/df$ (Chi-square/*df*) from the parsimonious fit category. In the first stage, the study found that the measurement model demonstrated adequate psychometric properties after dropping INFOQ3 and INFOQ5 from information quality and EXT2 from extraversion constructs due to low factor loadings. The results of the goodness of fit for the entire model and acceptable thresholds are reported in Table 2.

**Table 2: Measures of goodness of fit**

| Model fit Index | Values in this study | Recommended threshold values | Source |
|---|---|---|---|
| $x^2/df$ | 2.275 | ≤ 3.0 | Bentler and Bonett (1980) |
| **GFI** | 0.871 | ≥ 0.90 | Joreskog and Sorbom (1984) |
| **RAMSEA** | 0.081 | ≤ 0.08 | Hair et al. (2010) |
| **CFI** | 0.942 | ≥ 0.90 | Byrne (2009) |
| **TLI** | 0.978 | ≥ 0.90 | Byrne (2009) |

Convergent and discriminant validity was used to assess the measurement model and composite reliability (CR) was used to assess reliability. Table 3 indicates the results of convergent validity and reliability assessment. The results of convergent validity indicate that the average variance extracted (AVE) values for the constructs are great than 0.5, implying that the measurement items for each construct are theoretically related to each other (Fornell & Larcker, 1981) and the values for composite reliability are all above 0.7, implying that the measurement items have met the reliability threshold (Nunnally & Bernstein, 1994).

**Table 3: Convergent validity and reliability assessment**

| Construct | AVE | CR |
|---|---|---|
| Use | 0.652 | 0.878 |
| Service quality | 0.703 | 0.904 |
| Conscientiousness | 0.647 | 0.793 |
| Agreeableness | 0.562 | 0.771 |
| System quality | 0.649 | 0.902 |
| Extraversion | 0.519 | 0.801 |
| Neuroticism | 0.685 | 0.771 |
| Openness | 0.891 | 0.824 |
| Information quality | 0.788 | 0.907 |
| Satisfaction | 0.845 | 0.956 |
| Individual performance | 0.811 | 0.928 |

Concerning discriminant validity, the results confirm that the constructs of the study were distinct from each other since the intercorrelations of the constructs did not exceed the square root of the AVE of the constructs. Results of discriminant validity are reported in Table 4.

**Table 4: Discriminant validity assessment**

| | USE | SEQ | CONS | AGR | SYQ | EXT | NEU | OPN | INFQ | SAT | PER |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **USE** | **0.807** | | | | | | | | | | |
| **SEQ** | 0.661 | **0.838** | | | | | | | | | |
| **CONS** | 0.688 | 0.721 | **0.804** | | | | | | | | |
| **AGR** | 0.566 | 0.458 | 0.686 | **0.750** | | | | | | | |
| **SYQ** | 0.791 | 0.774 | 0.705 | 0.676 | **0.806** | | | | | | |
| **EXT** | 0.638 | 0.658 | 0.715 | 0.702 | 0.714 | **0.720** | | | | | |
| **NEU** | 0.265 | 0.104 | 0.418 | 0.427 | 0.271 | 0.382 | **0.828** | | | | |
| **OPN** | 0.838 | 0.862 | 0.910 | 0.924 | 0.917 | 0.916 | 0.456 | **0.943** | | | |
| **INFQ** | 0.860 | 0.714 | 0.711 | 0.657 | 0.766 | 0.769 | 0.217 | 0.741 | **0.887** | | |
| **SAT** | 0.850 | 0.694 | 0.772 | 0.599 | 0.866 | 0.791 | 0.215 | 0.826 | 0.842 | **0.919** | |
| **PER** | 0.856 | 0.749 | 0.807 | 0.591 | 0.851 | 0.733 | 0.280 | 0.825 | 0.896 | 0.861 | **0.901** |

***Legend***

*USE: Use* *SEQ: Service Quality* *CONS: Conscientiousness* *AGR: Agreeableness*
*SYQ: System Quality* *EXT: Extraversion* *NEU: Neuroticism* *OPN: Openness*
*INFQ: Information Quality* *SAT: Satisfaction* *PER: Performance*

***Note**: Bolded diagonal values are the square root of AVE, and correlational values are significant at $p < 0.001$.*

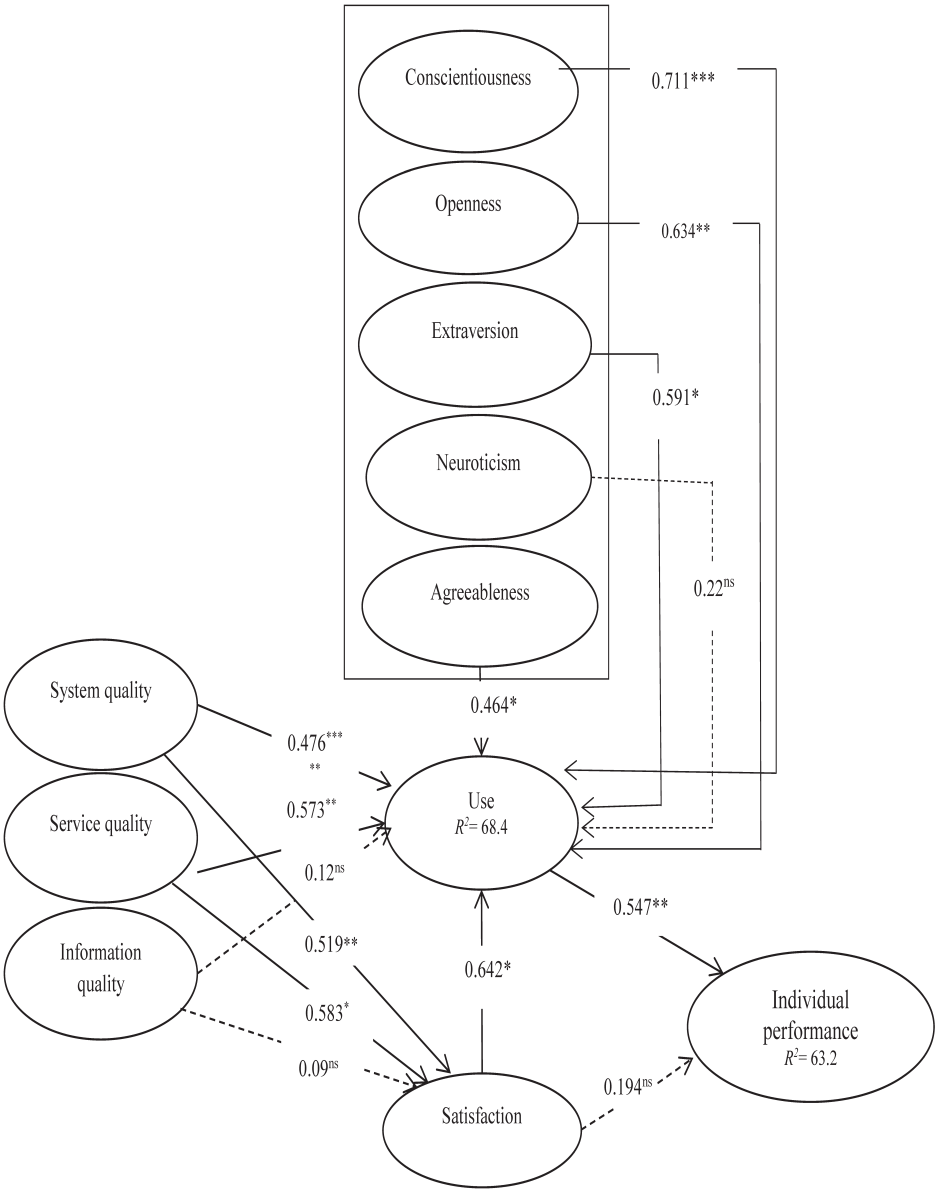
*Assessment of the structural model, and hypothesis testing*

In the second stage, the study assessed the structural model using the same model fit indices used in the assessment of the measurement model. The assessment of the structural model yielded the following goodness of fit: $x^2/df$ = 2.267, RAMSEA = 0.083, GFI = 0.870, CFI = 0.940, and TLI = 0.976. The model fit indices indicate that there is an adequate structural fit between the hypothesised model and the observed data. The explained variance ($R^2$) in use is 63.2% and in individual performance is 68.4%, suggesting that the model has good explanatory power as compared to similar studies and is good enough to produce substantial effects (Cohen, 1988). Results of hypothesis testing and the resulting path diagram are provided in Table 5 and Figure 2, respectively.

**Table 5: Results of hypothesis testing**

| Hypothesis | Relationship | | | t- values | β-values | Result |
|---|---|---|---|---|---|---|
| **H1** | SYQ | → | USE | 1.981 | 0.476 | Supported |
| **H2** | SEQ | → | USE | 2.191 | 0.573 | Supported |
| **H3** | INFQ | → | USE | 0.743 | 0.12 | Not supported |
| **H4** | SYQ | → | SAT | 2.133 | 0.519 | Supported |
| **H5** | SEQ | → | SAT | 2.217 | 0.583 | Supported |
| **H6** | INFQ | → | SAT | 0.409 | 0.09 | Not supported |
| **H7** | SAT | → | PER | 0.916 | 0.194 | Not supported |
| **H8** | USE | → | PER | 2.052 | 0.547 | Supported |
| **H9** | SAT | → | USE | 3.257 | 0.642 | Supported |
| **H10** | CONS | → | USE | 4.078 | 0.711 | Supported |
| **H11** | OPN | → | USE | 3.211 | 0.634 | Supported |
| **H12** | EXT | → | USE | 2.571 | 0.591 | Supported |
| **H13** | NEU | → | USE | 1.221 | 0.221 | Not supported |
| **H14** | AGR | → | USE | 1.971 | 0.464 | Supported |

**Figure 2: Path diagram**




***Note**: * p ≤ 0.05, ** p ≤ 0.01, *** p ≤ 0.001, ns: Not significant*

## 6. Discussion

***Unsupported hypotheses***

Four of the 10 hypotheses were *not* supported by the findings:

- H3: Information quality positively influences the use of mobile banking apps.
- H6: Information quality positively influences user satisfaction with mobile banking apps.
- H7: User satisfaction with mobile banking apps has a positive influence on individual performance.
- H13: Neuroticism has a negative influence on the use of mobile banking apps.

*Information quality and use (H3), information quality and user satisfaction (H6)*

One of the three DeLone and McLean (2003) quality measures—*information quality*—was found to not have a positive influence on either *use* or *user satisfaction* with the use of mobile banking apps. (Under *information quality*, the survey (see Appendix) probed the extent to which users found the information in the apps *useful, understandable*, *interesting*, *reliable*, *complete*, and *up to date*). This finding, which suggests that the surveyed users perceived the quality of the information provided by the mobile banking apps as being unsatisfactory and thus a disincentive to using the apps, appears to resonate with the findings of Chiu et al. (2016) on the adoption of mobile banking services in Philippines. Also, the study by Franque et al. (2021) in Mozambique finds that information quality had a positive influence on the *use* of mobile banking services, and the study by Kumar and Sharma (2019) in Oman finds that information quality had a positive influence on *user satisfaction* with such services.

*User satisfaction and individual performance (H7)*

Contrary to the study's expectations and the literature, user satisfaction was not found to positively influence *individual performance*—though it does, as seen later in this section, positively influence the *use* of mobile banking apps.

*Neuroticism and use (H13)*

Neuroticism was found to have no significant influence on the respondents' use of mobile banking apps. This finding appears to contrast with findings from several other studies. For example, studies by Loiacono (2015) in Italy and Ashraf (2019) in Lebanon find that neuroticism had a significant influence on, respectively, the intention to use social networking websites and the intention to use mobile banking. An earlier study, by Rosen and Kluemper (2008) in the US, finds that neurotics often perceive new technology negatively.

***Supported hypotheses***

Ten of the hypotheses—all except the four hypotheses discussed in the previous sub-section—were supported by the research findings.

*Openness*

The study found that openness has a positive influence on the use of Tanzanian mobile banking apps. It is plausible that mobile banking users consider the use of the apps to be a new experience and therefore they are attracted to using them. This finding would appear to be consistent with findings in studies by Kim and Jeong (2015) in South Korea and by McElroy et al. (2007) in the US, which find openness to be positively related to internet use, but the finding appears to contrast with the Barnett et al. (2014) finding that openness is unrelated to technology acceptance.

*Conscientiousness*

Similar to findings by Moslehpour et al. (2018) on the intention of Taiwanese to purchase goods and services online, this study found that conscientiousness positively influences Tanzanians' use of mobile banking apps. It is possible that this finding stems from a belief that using mobile banking apps can improve financial management discipline and offer greater reliability in making business transactions.

*Extraversion*

Extraversion was also found to have a positive influence on the use of mobile banking apps, a finding that appears to be consistent with findings from several previous studies, such as the Panda and Jain (2018) study of the obsessive use of smartphones among young Indians, and the Lissitsa and Kol (2021) study of mobile shopping among members of the so-called "generation Y" (i.e., people reaching adulthood at the turn of the millennium) in Israel. Devaraj et al. (2008) find that because extraverts are socially inclined, outgoing, and like to create connections, they are amenable to the use of advanced technology to achieve socially oriented goals.

*Agreeableness*

The core of agreeableness behaviour is maintaining a positive relationship with others (Graziano & Eisenberg, 1997). Given the importance of one's relationship with one's bank, the respondents could reasonably be expected to choose to use the mobile banking apps, upon being introduced to them by their respective banks, to maintain their relationship with their banks. This finding appears to be consistent with that of Khan et al. (2019) on the use of mobile payment systems in China.

*System quality and use, service quality and use*

Two of the three DeLone and McLean (2003) IS quality measures—*system quality* and *service quality*—were found to positively influence the *use* of mobile banking

apps. These findings appear to be in line with previous studies in technology acceptance literature. For example, Mohammadi (2015) finds that these two factors influenced the use of e-learning in Iran.

*System quality and user satisfaction, service quality and user satisfaction*
Two of the three DeLone and McLean (2003) IS quality measures—*system quality* and *service quality*—were also found to positively influence *user satisfaction* with the use of mobile banking apps. This finding apparently aligns with that of Veeramootoo et al. (2018) on the use of e-government services in Mauritius.

*User satisfaction and use*
Unsurprisingly, user satisfaction was found to positively influence use, a finding that appears to be consistent with the findings of Shim and Jo (2020), who investigated the use of health informatics sites in South Korea.

***Limitations and further studies***
This study was conducted with respondents living in a single country, Tanzania. Future studies would benefit from involving respondents from more than one country, so as to account for the effects of national and cultural differences on the final results. Also, some of the studied constructs, particularly those used to measure personality traits, may have been perceived by some respondents as carrying a negative meaning. Hence, their responses could have been influenced by notions of social acceptability. Future studies could supplement questionnaire data with an additional data source in using a combination of data collection methods to overcome the potential common methods biases.

## 7. Conclusions

The study offers a research framework which combines the consideration of personality traits and IS success factors in influencing Tanzanians' *use* of, and *satisfaction* with, mobile banking apps. This model enhances our understanding of the influence of personality traits on the acceptance of mobile banking apps. Studies which have studied these traits in the context of the IS success model, particularly in the African context, are limited. This study's identification of strong positive relationships between four personality traits—*openness*, *agreeableness*, *conscientiousness*, and *extraversion*—and both use and user satisfaction suggests that banks can benefit from ensuring that users can give full expression to their personalities when using the apps. If developers can design mobile banking apps which allow each customer to have a sense of expressing their unique personality traits, the customer's use and user satisfaction can be expected to increase.

Also of potential value to developers is the finding that one of the three IS success factors—*information quality*—is not at present positively influencing Tanzanian mobile banking users. This is an apparent indication that developers of mobile banking

apps for the Tanzanian market need to place greater emphasis on ensuring that the information provided is, according to the terms used in the survey, *useful*, *understandable*, *interesting*, *reliable*, *complete*, and *up to date*.

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## Appendix: Statements used in the survey questionnaire

| Code | Statement | Source |
|---|---|---|
| *System quality* | | Urbach et al. (2010) |
| **SYQ1** | The mobile banking app is easy to navigate. | |
| **SYQ2** | The mobile banking app allows me to easily find the information I am looking for. | |
| **SYQ3** | The mobile banking app is easily structured. | |
| **SYQ4** | The mobile banking app offers appropriate functionality. | |
| **SYQ5** | Mobile banking is easy to use. | |
| *Service quality* | | |
| **SEQ1** | The responsible personnel are always willing to help whenever I need support with a mobile banking app. | |
| **SEQ2** | The responsible personnel provide services related to the mobile banking app at the promised time. | |
| **SEQ3** | The responsible personnel have adequate knowledge to answer my questions concerning the mobile banking app. | |
| **SEQ4** | The responsible personnel provide personal attention whenever I experience problems with the mobile banking app. | |
| *Information quality* | | |
| **INFQ1** | The information provided by the mobile banking app is useful. | |
| **INFQ2** | The information provided by the mobile banking app is understandable. | |
| **INFQ3** | The information provided by the mobile banking app is interesting. | |
| **INFQ4** | The information provided by the mobile banking app is reliable. | |
| **INFQ5** | The information provided by the mobile banking app is complete. | |
| **INFQ6** | The information provided by the mobile banking app is up to date. | |
| *Use* | | |
| **USE 1** | I use a mobile banking app. | |
| **USE 2** | I use the mobile banking app to manage my accounts. | |
| **USE 3** | I use the mobile banking app to make transfers. | |
| **USE 4** | I use the mobile banking app to make in-app purchases. | |
| *User satisfaction* | | Bhattacherjee (2001) |
| **SAT1** | I am satisfied that the mobile banking app meets my information processing needs. | |
| **SAT2** | I am satisfied with the mobile banking app efficiency. | |
| **SAT3** | I am satisfied with the mobile banking app effectiveness. | |
| **SAT4** | Overall, I am satisfied with the mobile banking app. | |

| | | |
|---|---|---|
| ***Individual performance*** | | Goodhue and Thompson (1995) |
| **PERF1** | The mobile banking app helps me to accomplish banking-related tasks more quickly. | |
| **PERF2** | The mobile banking app makes it easier to accomplish tasks. | |
| **PERF3** | The mobile banking app is useful for me. | |
| ***Openness*** | | Donnellan et al. (2006); Goldberg (1999) |
| **OPN1** | I enjoy imagining new and different ideas. | |
| **OPN2** | I experience difficulty in comprehending abstract ideas | |
| **OPN3** | I am not keen to engage myself in intellectual discussions. | |
| **OPN4** | I do not enjoy daydreaming. | |
| ***Conscientiousness*** | | |
| **CONS1** | I get chores done the right way. | |
| **CONS2** | I like to keep things in order. | |
| **CONS3** | I often forget to put things back in their proper place. | |
| **CONS4** | Many a time, I mess up things. | |
| ***Extraversion*** | | |
| **EXT 1** | I enjoy partying frequently. | |
| **EXT 2** | I enjoy talking to new people, who are different from me. | |
| **EXT 3** | I do enjoy socializing. | |
| **EXT 4** | I enjoy going out to help people in need. | |
| ***Agreeableness*** | | |
| **AGR1** | I sympathise with others frequently. | |
| **AGR2** | I feel for others. | |
| **AGR3** | I don't care what others are really doing. | |
| **AGR4** | I go with the majority. | |
| ***Neuroticism*** | | |
| **NEU1** | I experience frequent mood swings. | |
| **NEU2** | I get upset easily. | |
| **NEU3** | I am relaxed most of the time. | |
| **NEU4** | I seldom feel blue. | |