# AN ASSESSMENT OF THE INFRASTRUCTURAL READINESS FOR TRANSITIONING TO A CASHLESS SOCIETY IN NIGERIA: NAVIGATING TECHNOLOGICAL LIMITATIONS IN THE ENFORCEMENT OF A CASHLESS POLICY

MSc Research Project
Fintech

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# Configuration Manual

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## 1. Introduction

The configuration manual functions as a user guide, providing technical specifics, specifications, and procedures necessary for replicating the research analysis in the study titled "An Assessment of the Infrastructural Readiness for Transitioning to a Cashless Society in Nigeria: Navigating Technological Limitations in the Enforcement of a Cashless Policy". It encompasses hardware and software configurations, ensuring reproducibility and transparency for researchers to validate findings and scrutinize thesis results.

## 2. Technical Specifications

### 2.1. Hardware Configuration

| Table 1: Hardware Specifications for research | |
|---|---|
| **Processor** | Intel(R) Core (TM) i3-8130U CPU @ 2.20GHz 2.20 GHz |
| **Memory** | 12.0 GB |
| **System configuration** | 64-bit operating system, x64-based processor |
| **Operating System** | Windows 10 Pro |

### 2.2. Software Configuration

| Table 2: Software configurations for research | | |
|---|---|---|
| **R Studio** | R programming language and Rstudio 2023.06.1+524 "Mountain Hydrangea" release for Windows | For Descriptive Statistics, Chi-square Test, Cronbach's Alpha Test and Factor Analysis. |
| **Microsoft Excel** | Version 2202 Build 16.0.14931.20128 64-bit | The data was converted to a CSV format for Excel, enabling frequency analysis and numerical representation of five-point Likert scale responses (1 to 5). |
| **Microsoft Word** | Version 2202 Build 16.0.14931.20128) 64-bit | For writing report |
| **Google Form** | | An online questionnaire development tool that operates through a web-based application. |

## 3. Data Analysis

### 3.1. Data

This research project employed a quantitative primary data collection method in alignment with the Unified Theory of Acceptance and Use of Technology (UTAUT) constructs. Data was gathered through a questionnaire accessed via Google Forms, and subsequently downloaded to Excel for analysis.

### 3.2. Data Preprocessing on Excel

The acquired survey data was visualized and subjected to preliminary processing through Microsoft Excel. The levels of agreement were assessed using a five-point Likert scale, where (5) signified "Strongly Agree," (4) indicated "Agree," (3) denoted "Indifference," (2) represented "Disagree," and (1) corresponded to "Strongly Disagree." The Excel "Replace" function was employed to transform "Prefer to not say" responses into "PTNS," guaranteeing both uniqueness and uniformity.

## 3.3. Data Analysis on R Studio

### 3.3.1. Installation of Packages

Table 3: Package Installations

| Name | Version | Use |
|---|---|---|
| library(readxl) | 1.4.3 | reading Excel files |
| library(dplyr) | 1.1.2 | data manipulation |
| library(tibble) | 3.2.1 | data structure |
| library(skimr) | 2.1.5 | summary statistics |
| library("FactoMineR") | 2.8 | multivariate analysis |
| library("factoextra") | 1.0.7 | data visualization |
| library(corrplot) | 0.92 | correlation plot for variables |
| library(ggplot2) | 3.4.2 | data visualization |
| library(psych) | 2.3.6 | psychological measurement for Cronbach's Alpha test |
| library(gridExtra) | 2.3 | arranging plots |
| library(grid) | 4.3.1 | grid-based graphics |
| library(nFactors) | 2.4.1.1 | factor analysis |
| library(RcmdrMisc) | 2.7-2 | miscellaneous R Commander |
| library(GPArotation) | 2023.3-1 | factor rotation |

### 3.3.2. Data Preparation

- Import Dataset - The data is imported into the software using the code snippet below

```
setwd("C:\\Users\\hp\\OneDrive\\Desktop\\LAYO\\Third Semester\\THESES")
Survey <- read.csv("SURVEY.csv", header=T, na.strings=c(""), stringsAsFactors = T)
```

- Removal of unnecessary columns which includes timestamp, serial number (S.N), and country of residence since all respondents are Nigerians.

```
Survey_Org <- subset(Survey, select = -c(Timestamp, Country.of.residence, S.N))
```

- Renaming of variables or columns to clearly signify the UTAUT constructs they represent, namely performance expectancy (PE), effort expectancy (EE), social influence (SI), and facilitating conditions (FCS).

```
colnames(Survey_Org)[5:6] <- paste("EE", 1:2, sep="")
colnames(Survey_Org)[7:12] <- paste("FC", 1:6, sep="")
colnames(Survey_Org)[13:15] <- paste("PE", 1:3, sep="")
colnames(Survey_Org)[16:19] <- paste("SI", 1:4, sep="")
```

- Data was thoroughly examined for missing values, and fortunately, no missing data was found.

```
sapply(Survey_Org,function(x) sum(is.na(x)))
       Age     Gender Occupation   Location        EE1        EE2        FC1        FC2 
         0          0          0          0          0          0          0          0 
       FC3        FC4        FC5        FC6        PE1        PE2        PE3        SI1 
         0          0          0          0          0          0          0          0 
       SI2        SI3        SI4 
         0          0          0 
```

### 3.3.3. Data Analysis

- **Descriptive analysis** - Utilizing the `skimr()` package and code `summary(Survey_Org)`, descriptive statistics like mean, standard deviation, skewness, kurtosis, and standard error were employed to depict demographic frequency distribution characteristics.
- **Chi-Square test** – To carry out this the following steps were carried out:
  - → Use `glimpse(Survey_Org)` and `dim(Survey_Org)` to view the dataframe concise summary and dimensions respectively.
  - → Convert from factor and replace the demographic variables (age, gender, location, and occupation) with numerical values

```
> Survey_Org$Age <- as.numeric(factor(Survey_Org$Age, levels = c('18-29', '30-39', '4
0-65', 'PTNS'), labels = c(1, 2, 3, 4)))
>
> Survey_Org$Gender <- as.numeric(factor(Survey_Org$Gender, levels = c('Male', 'Femal
e', 'PTNS'), labels = c(1, 2, 3)))
>
> Survey_Org$Location <- as.numeric(factor(Survey_Org$Location, levels = c('Rural',
'Urban'), labels = c(1, 2)))
>
> Survey_Org$Occupation <- as.numeric(factor(Survey_Org$Occupation, levels = c('Emplo
yed', 'Self Employed', 'Unemployed', 'Student'), labels = c(1, 2, 3, 4)))
```

  - → Convert back the numerical demographic variables back to factor

```
Survey_Org$Age <- factor(Survey_Org$Age)
Survey_Org$Gender <- factor(Survey_Org$Gender)
Survey_Org$Location <- factor(Survey_Org$Location)
Survey_Org$Occupation <- factor(Survey_Org$Occupation)
```

  - → compute chi test which determines the significant relationship between the demographic variables and the UTAUT modelled questions with the function snippet below:

```
demographic_vars <- c("Age", "Gender", "Occupation", "Location")
Survey_vars <- colnames (Survey_Org) [5:19]
for (demographic_var in demographic_vars) {
for (Survey_var in Survey_vars) {
print (paste("For", demographic_var, "and", Survey_var))
  crosstab <- table(Survey_Org[[demographic_var]], Survey_Org[[Survey_var]])
print(chisq.test(crosstab,simulate.p.value = TRUE, B=10000))
    }
}
```

- **Crobach's Alpha** – New data frames were generated corresponding to the categories within the UTAUT model for each question. The outcomes were acquired using the function `psych::alpha()`.

```
# Create a subset of the data containing only the UTAUT-related question
UTAUT_Model <- Survey_Org[, c("EE1", "EE2", "FC1", "FC2", "FC3", "FC4",
                              "FC5", "FC6", "PE1", "PE2", "PE3", "SI1",
                              "SI2", "SI3", "SI4")]

#To compute Cronbach's alpha reliability test
cronbach.alpha <- psych::alpha(UTAUT_Model)
print(cronbach.alpha)

# Create a table to summarize Cronbach's alpha results for the four beha
summary_table <- tibble(
  Behavioral_Intentions = c("Effort Expectancy", "Performance Expectancy
                            "Facilitating Conditions", "Social Influence
  Raw_Alpha = c(0.73, 0.73, 0.74, 0.72),
  Standardized_Alpha = c(0.71, 0.70, 0.70, 0.68),
  G6_SMC = c(0.77, 0.76, 0.76, 0.75),
  Average_R = c(0.15, 0.14, 0.14, 0.14),
  Median_R = c(0.14, 0.13, 0.12, 0.11)
)
# Print the summary table
print(summary_table)
```

- **Factor Analysis** – A separate data frame was formed, excluding demographic data, since the analysis is applicable solely to values.
  - → **Bartlett's Test of Sphericity** - This is utilized to determine if a correlation matrix significantly deviates from an identity matrix, as indicated by the cor() function. This test aids in evaluating the suitability of data for factor analysis by examining the inter-variable relationships.

```
Survey2 <- subset(Survey_Org, select = -c(Age, Gender, Occupation,
                                          Location))
describe(Survey2)

# Perform Bartlett's test of sphericity
Survey_matrix <- cor(Survey2)
corrplot(Survey_matrix, method="number")
cor_matrix <- cor(Survey2, use = "pairwise.complete.obs")  # Compu
n <- sum(!is.na(Survey2))
result <- cortest.bartlett(cor_matrix, n = n)
print(result)
```

  - → **Scree plot** – This is employed to display the eigenvalues of the factors derived from the factor analysis. This visualization is graphically represented using ggplot() to offer a clear visual depiction of the eigenvalues' significance in the context of the analysis.

```
FAfit <- fa(cor_matrix,nfactors = ncol(Survey2), rotate = "none")
n_factors <- length(FAfit$e.values)
FAfit$e.values
scree     <- data.frame(
  Factor_n =  as.factor(1:n_factors),
  Eigenvalue = FAfit$e.values)
ggplot(scree, aes(x = Factor_n, y = Eigenvalue, group = 1)) +
  geom_point() + geom_line() +
  xlab("Number of factors") +
  ylab("Initial eigenvalue") +
  labs( title = "Scree Plot",
        subtitle = "(Based on the unreduced correlation matrix)")
```

  - → **Exploratory factor analysis** – An initial factor analysis was conducted to unveil latent factors elucidating the interrelations among observed variables. The utilization of varimax rotation aimed to enhance the comprehensibility of these factors' interpretations, streamlining the analysis process.

```
efa_result <- fa(cor_matrix, nfactors = 4, rotate = "varimax")
print(efa_result)

factor_loadings <- efa_result$loadings
print(factor_loadings)
fa.diagram(efa_result, main="Factor Analysis")
```

    Subsequent to the initial factor analysis, a refined exploration was undertaken employing Kaiser's rule and promax rotation. This aimed to enhance the structural coherence, streamline the model by consolidating factors, and augment interpretability. Findings indicated that the essence of the dataset's variance is succinctly represented by two factors, underscoring their substantial relevance in the analysis.

```
kaisers_rule <- EFA_result$values > 1
num_factors_kaiser <- sum(kaisers_rule)

rotated_efa <- fa(cor_matrix, nfactors = num_factors_kaiser,
                  rotate = "promax")
print(rotated_efa)
fa.diagram(rotated_efa, main="Factor Analysis")
```

| APPENDIX - TABLE 2: STATISTICAL ANALYSIS ON CONSTRUCT | | | | | | |
|---|---|---|---|---|---|---|
| **Questions** | **Variables** | **Mean** | **Standard Deviation (sd)** | **Skewness** | **Kurtosis** | **Standard Error (se)** |
| The present electronic payment infrastructure in Nigeria effectively caters to the requirements of diverse demographic segments (age, gender, occupation). | EE1 | 3.09 | 1.26 | -0.04 | -1.25 | 0.1 |
| The current infrastructure for cashless payment provides users with a high degree of convenience and usability | EE2 | 4.82 | 0.52 | -4.23 | 23.39 | 0.04 |
| The availability of reliable internet connectivity is crucial for a successful transition to a cashless society. | FC1 | 4.7 | 0.75 | -3.09 | 10.04 | 0.06 |
| The current physical infrastructure, such as point-of-sale terminals and automated teller machines, are deemed sufficient in facilitating cashless transactions. | FC2 | 2.91 | 1.34 | 0.27 | -1.31 | 0.11 |
| The current payment infrastructure that enables cashless transactions sufficiently caters to the demands of both urban and rural regions of Nigeria | FC3 | 2.56 | 1.31 | 0.49 | -1.06 | 0.11 |
| For a cashless society to succeed, cooperation between governmental organisations, financial institutions, and technology suppliers is essential. | FC4 | 4.66 | 0.65 | -2.83 | 11.33 | 0.05 |
| The current cashless payment infrastructure ensures secure and private transactions. | FC5 | 3.6 | 1.13 | -0.58 | -0.55 | 0.09 |
| The existing cashless payment infrastructure in Nigeria supports seamless integration across various sectors (e.g., retail, transportation). | FC6 | 2.85 | 1.24 | 0.06 | -1.23 | 0.1 |
| Financial literacy programs are necessary to enhance understanding and usage of cashless payment methods. | PE1 | 4.56 | 0.72 | -2.13 | 5.75 | 0.06 |
| Alternative payment methods (e.g., mobile wallets, online platforms) contribute to the readiness for a cashless society in Nigeria. | PE2 | 4.23 | 0.85 | -1.28 | 1.69 | 0.07 |
| User confidence in the security of cashless transactions is a significant factor in the transition to a cashless society in Nigeria. | PE3 | 4.37 | 0.85 | -1.42 | 1.43 | 0.07 |
| The Nigerian regulatory framework is geared towards encouraging and enabling the use of cashless payment technologies. | SI1 | 3.48 | 1.15 | -0.6 | -0.57 | 0.09 |
| The advent of cashless payment methods has significantly enhanced financial inclusion in Nigeria. | SI2 | 3.81 | 0.99 | -0.8 | -0.08 | 0.08 |
| Financial incentives and rewards for using cashless payment methods encourage their adoption in Nigeria. | SI3 | 3.81 | 1.11 | -0.82 | -0.11 | 0.09 |
| Awareness campaigns and education initiatives play a crucial role in promoting the adoption of cashless payment methods in Nigeria. | SI4 | 4.44 | 0.75 | -1.37 | 1.63 | 0.06 |

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