National College of Ireland

Configuration Manual

Facilitating Business Transactions in the Digital Era: An Analysis of the Impact of FinTech Development in Indonesia's E-commerce

MSc Research Project
MSc in FinTech (MSCFTD1)

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MSc Project Submission Sheet

School of Computing

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Programme: MSc in FinTech (MSCFTD1) Year**:** 2022/2023

Module: Research Project

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Submission Due Date: 14 August 2023

Project Title: Facilitating Business Transactions in the Digital Era: An Analysis of the Impact of FinTech Development in Indonesia's E-commerce

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Configuration Manual

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1 Introduction

The system specifications and processes essential for the reproducibility of the analysis conducted as part of the study are described in this configuration manual as a requirement for submission of the research paper titled "Facilitating Business Transactions in the Digital Era: An Analysis of the Impact of FinTech Development in Indonesia's E-commerce."

2 System Requirements

2.1 Hardware

Device name : Benny's MacBook Air
Chip : Apple M1
Memory : 8 GB
Startup disk : Macintosh HD
macOS : Ventura 13.4

2.2 Software

- Google Form: This tool was used to deploy the survey questions.
- Microsoft Excel for Mac version 16.75: The data is extracted into a format that can be read by Excel and from the results of the questionnaire the variable data is converted into a numeric so that it can be processed in R-Studio.
- Microsoft Word for Mac version 16.75: Used to make research projects.
- RStudio 2022.07.2 Build 576: The programming language for Mac is used to perform the following statistical techniques: Confirmatory Factor Analysis, Chi-square Test, Cronbach's Alpha Test, and Factor Analysis.

3 Data Processing

The research project focused on primary data that was gathered using a Google Forms-deployed electronic questionnaire.

3.1 Install Package

library(lavaan): Used for the analysis of structural equation models (structural equation modelling/SEM) allowing to examine the relationships between variables in statistical models.

library(psych): Used to calculate descriptive statistics, perform factor analysis, correlation matrices, and reliability analysis.

library(ltm): Used to understand how individuals answer questions on tests or quizzes and how individual characteristics influence their answer patterns.

library(car): Useful for analysing linear and non-linear regression models, testing assumptions, visualizing, and evaluating models.

library(ggplot2): Useful for plotting data in a variety of formats, including scatter plots, bar plots, line plots, and so on.

3.2 Data Preparation

Convert a variable to numeric in Excel.

Changing some of the variables measured into a Likert scale with a total of 5 points with a scale of strongly disagree = 1, disagree = 2, neutral = 3, agree = 4, strongly agree = 5.

Changing questions 1 to 15 in the questionnaire to Q1 to Q15 in Excel to facilitate data processing in R-Studio.

Import Dataset from Excel

Deleting unnecessary columns from the dataset
Data_Research <- Data_Research [, -1]

3.3 Data Analysis

3.3.1 Confirmatory Factor Analysis

Cfa <- 'f =~
Q1+Q2+Q3+Q4+Q5+Q6+Q7+Q8+Q9+Q10+Q11+Q12+Q13+Q14+Q15'
Create a Cfa variable that contains a string representing the structural equation model (confirmatory factor analysis/CFA) to be analysed. The CFA model is used to test whether the items (Q1-Q15) in the questionnaire measure the latent factor (called f in the model).

Itemcfa <- cfa(Cfa, data=Data_Research)
The cfa() function from the lavaan library for building structural equation models (CFA).

summary (Itemcfa)
Provides a summary of the results from the analysis of the CFA model which includes parameter estimates, p-values, and other relevant statistics.

summary (Itemcfa, fit.measure=TRUE, standardized=TRUE)
Another call to the summary () function on the Itemcfa object, but with additional arguments. The fit.measure=TRUE argument will include measurements of fit to the model, such as chi-

square, CFI, TLI, and RMSEA, while standardized=TRUE will return parameters that have been standardized.

Result:

	Estimate	Std.Err	z-value	P(>|z|)	Std.lv	Std.all
f =~						
Q1	1.000				0.362	0.508
Q2	1.176	0.216	5.439	0.000	0.426	0.495
Q3	1.148	0.192	5.982	0.000	0.416	0.573
Q4	1.271	0.227	5.603	0.000	0.460	0.517
Q5	1.195	0.203	5.872	0.000	0.433	0.556
Q6	1.186	0.196	6.042	0.000	0.430	0.582
Q7	1.391	0.198	7.019	0.000	0.504	0.770
Q8	1.481	0.223	6.648	0.000	0.537	0.690
Q9	1.515	0.228	6.656	0.000	0.549	0.691
Q10	1.201	0.194	6.185	0.000	0.435	0.606
Q11	1.268	0.239	5.312	0.000	0.459	0.478
Q12	1.366	0.218	6.275	0.000	0.495	0.621
Q13	1.395	0.209	6.661	0.000	0.505	0.692
Q14	1.228	0.189	6.485	0.000	0.445	0.658
Q15	1.386	0.202	6.845	0.000	0.502	0.731

#help(cfa)

To access documentation or help for a specific function.

cronbach.alpha(Data_Research)

For the cronbach.alpha() function from the psych library, which is used to calculate the reliability coefficient Cronbach's alpha from data supplied in the Data_Research object.

Result:

```
Cronbach's alpha for the 'Data_Research' data-set

Items: 15
Sample units: 195
alpha: 0.896
```

3.3.2 Factor Analysis

X <- Data_Research

Creates a new variable X from the Data_Research object to create a separate reference to the original data stored in Data_Research.

Y <- Data_Research[,1]

Creates a new variable Y from the Data_Research object to work with certain variables that consist only of the first column.

KMO(r=cor(X))

Derived from the psych library was used to calculate the Kaiser-Meyer-Olkin (KMO) value to measure the fit of the data to factor analysis. KMO values range between 0 and 1, and higher values indicate that the data fits the factor analysis.

Result:

```
> KMO(r=cor(X))
Kaiser-Meyer-Olkin factor adequacy
Call: KMO(r = cor(X))
Overall MSA =  0.89
MSA for each item =
  Q1   Q2   Q3   Q4   Q5   Q6   Q7   Q8   Q9  Q10  Q11  Q12  Q13  Q14  Q15
0.87 0.87 0.87 0.86 0.87 0.86 0.91 0.90 0.89 0.88 0.90 0.91 0.91 0.87 0.93
```

cortest. bartlett(X)

Derived from the psych library was used to perform Bartlett's sphericity test on the data to check whether the data correlation matrix is significantly different from the identity matrix. If the p-value of this test is low, it indicates that the data is suitable for factor analysis.

Result:

```
> cortest.bartlett(X)
R was not square, finding R from data
$chisq
[1] 1295.899

$p.value
[1] 2.409055e-204

$df
[1] 105
```

fafitfree <- fa (Data_Research, nfactors = ncol(X), rotate = "none"):

the fa () function from the psych library to perform exploratory factor analysis (EFA) on the data contained in the Data_Research object. The nfactors argument is set to be the number of columns in the data matrix (ncol(X)), which by default indicates a factor analysis with the number of factors equal to the number of variables in the data. The rotate argument is set as "none", meaning it will not factor rotate at this stage. The factor analysis results are stored in the fafitfree object.

n_factors <- length (fafitfree$e. values):

Calculates the number of factors based on the length of the eigenvalue vector (e.values) resulting from the previous factor analysis. It will be used next to describe scree plots.

fafitfree$e. values:

The command that accesses the eigenvalue vector (e.values) of the fafitfree object. This vector contains the eigenvalues for each factor resulting from the factor analysis.

```
> fafitfree$e.values
 [1] 6.3225599 1.4146688 1.3191814 0.9409785 0.7633658 0.6723394 0.5838196 0.5102240 0.4489606 0.4265583 0.3732507
[12] 0.3611699 0.3340611 0.2778281 0.2510338
```

scree <- data.frame(Factor_n = as.factor(1: n_factors), Eigenvalue = fafitfree$e.values):
Create a new data frame named scree. This data frame has two columns: Factor_n (the nth factor) which is represented as a factor, and Eigenvalue which contains the eigenvalues for that factor.

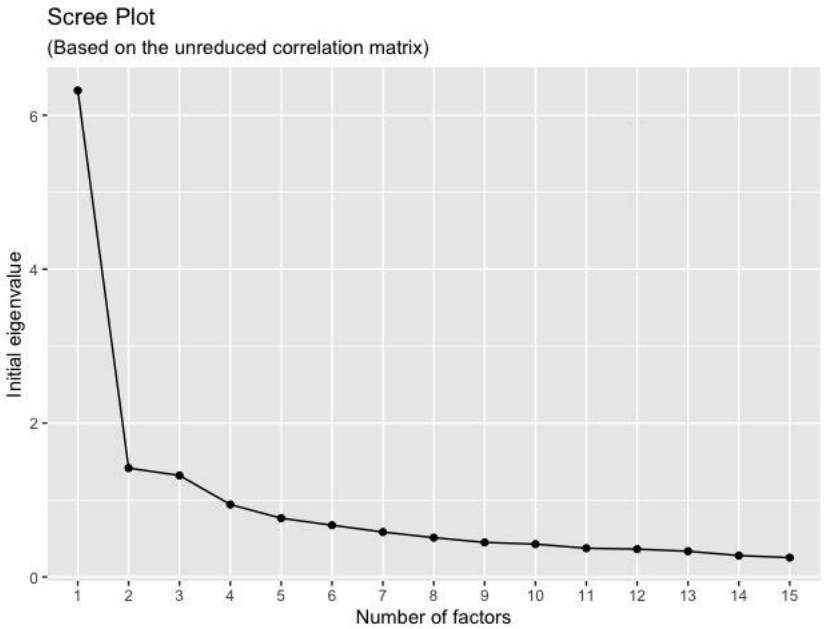
ggplot(...): This is for plotting

aes(x = Factor_n, y = Eigenvalue, group = 1):
The x-axis to the factor is represented as the nth factor and the y-axis to the eigenvalues.

geom_point() + geom_line():
The visualization layer in the plot. geom_point() adds points for each factor with the corresponding eigenvalues, while geom_line() connects the points with lines.

xlab("Number of factors") + ylab("Initial eigenvalue"):
Sets the x-axis and y-axis labels on the plot.

labs (title = "Scree Plot", subtitle = "(Based on the unreduced correlation matrix)"):
Sets the plot title and subtitle.



fa.none <- fa (r=X, nfactors = 3, fm='pa', max.iter=100, rotate='varimax'):
The fa () function from the psych library to perform exploratory factor analysis (EFA) with multiple arguments specified nfactors = 3: is the number of factors set for extraction into 3 factors and performs factor rotation with the varimax method after factor analysis.

print (fa. none):

To print a summary of the results of the factor analysis stored in the fa.none object including the value of factor loadings, communalities, and other relevant information.

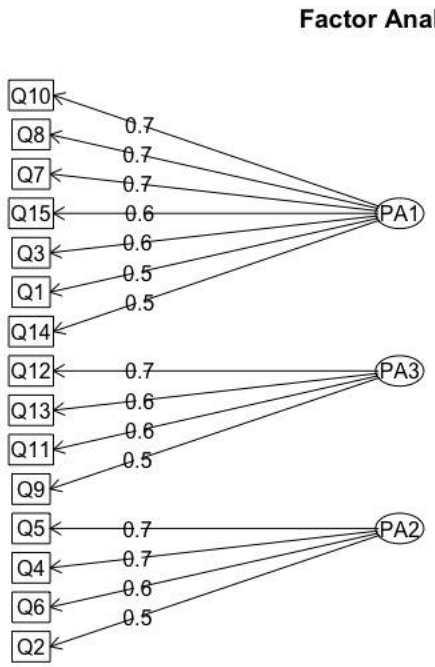
fa.diagram(fa.none):

From the psych library to generate factor diagrams.

Result:

```
Factor Analysis using method =  pa
Call: fa(r = X, nfactors = 3, rotate = "varimax", max.iter = 100, fm = "pa")
Standardized loadings (pattern matrix) based upon correlation matrix
     PA1  PA3  PA2   h2   u2 com
Q1  0.51 0.12 0.19 0.31 0.69 1.4
Q2  0.15 0.31 0.52 0.39 0.61 1.8
Q3  0.58 0.05 0.32 0.44 0.56 1.6
Q4  0.16 0.21 0.67 0.52 0.48 1.3
Q5  0.26 0.11 0.71 0.59 0.41 1.3
Q6  0.29 0.16 0.65 0.53 0.47 1.5
Q7  0.65 0.36 0.24 0.61 0.39 1.9
Q8  0.68 0.25 0.17 0.55 0.45 1.4
Q9  0.47 0.49 0.22 0.50 0.50 2.4
Q10 0.68 0.16 0.11 0.49 0.51 1.2
Q11 0.07 0.63 0.22 0.45 0.55 1.3
Q12 0.25 0.72 0.16 0.61 0.39 1.3
Q13 0.38 0.64 0.20 0.59 0.41 1.8
Q14 0.50 0.44 0.14 0.46 0.54 2.1
Q15 0.59 0.29 0.33 0.54 0.46 2.1

                       PA1  PA3  PA2
SS loadings           3.15 2.26 2.18
Proportion Var        0.21 0.15 0.15
Cumulative Var        0.21 0.36 0.51
Proportion Explained  0.42 0.30 0.29
Cumulative Proportion 0.42 0.71 1.00
```



```
Mean item complexity =  1.6
Test of the hypothesis that 3 factors are sufficient.

df null model =  105  with the objective function =  6.89 with Chi Square =  1295.9
df of  the model are 63  and the objective function was  0.79

The root mean square of the residuals (RMSR) is  0.04
The df corrected root mean square of the residuals is  0.06

The harmonic n.obs is  195 with the empirical chi square  81.58  with prob <  0.058
The total n.obs was  195  with Likelihood Chi Square =  147.3  with prob <  1e-08

Tucker Lewis Index of factoring reliability =  0.881
RMSEA index =  0.083  and the 90 % confidence intervals are  0.066 0.101
BIC =  -184.9
Fit based upon off diagonal values = 0.99
Measures of factor score adequacy
                                                PA1  PA3  PA2
Correlation of (regression) scores with factors   0.87 0.85 0.86
Multiple R square of scores with factors          0.76 0.73 0.73
Minimum correlation of possible factor scores     0.53 0.45 0.46
```

Appendix

Table 1: Questionnaire and Frequency Analysis of Responses

Likert scale with a total of 5 points with a scale of strongly disagree = 1, disagree = 2, neutral = 3, agree = 4, strongly agree = 5.

Question	Abbr.	1	2	3	4	5
Please rate the level of convenience in using digital payment services in online transaction processes through various payment options on the E-commerce platform:	Q1	0	2	23	87	80
Please rate the level of security of personal information in digital payment methods compared to traditional payment methods on E-commerce platforms:	Q2	2	17	63	87	26
Please rate the level of effectiveness and efficiency of digital payment services so that they can increase your satisfaction in conducting online business transactions on the E-commerce platform:	Q3	1	3	16	92	83
Please rate the level of security of digital payment services in maintaining data security, including personal information such as full name, date of birth, and home address, and financial information such as credit card data, bank account numbers and PIN numbers on the E-commerce platform:	Q4	4	19	74	76	22

Please rate the level of security of digital payment services in providing adequate security protection using the latest security technologies such as 2FA (Two Factor Authentication) / Multi-Factor Authentication, data encryption, and secure payment history information storage in online business transactions on E-commerce platforms:	Q5	2	6	36	110	41
Please rate the level of security regarding the details of security notifications provided by digital payment services, such as verification of OTP (one-time password) code transactions, blocking, and reporting of suspicious transactions when making payment transactions to prevent fraud on the E-commerce platform:	Q6	2	5	33	119	36
Please rate the level of ease of use of digital payment services that are designed to be user-friendly, so that they are easy to understand when transacting on the E-commerce platform:	Q7	1	1	20	118	55
Please rate the convenience level of digital payment services in making it easier for users to use them on various devices such as smartphones and computers when transacting on E-commerce platforms:	Q8	2	5	23	106	59
Please rate the convenience level of digital payment services that make it easy for users to be accessed from any geographical location if they are connected to the internet to transact on the E-commerce platform:	Q9	1	7	38	101	48
Please rate the effectiveness of digital payment services when compared to cash payments (traditional payment methods) when shopping online on E-commerce platforms:	Q10	3	24	93	75	0
Please rate the level of cost-effectiveness of digital payment services in reducing additional transaction costs, such as admin fees or shipping costs, associated with processing payments when shopping online on the E-Commerce platform:	Q11	5	21	59	80	30
Please assess the level of comparison of digital payment services in providing services comparable to the admin fees paid, such as the ease of transactions when shopping online on E-commerce platforms:	Q12	13	47	102	33	0
Please assess the level of clarity of digital payment services in providing information about managing	Q13	1	7	39	117	31

user data and providing privacy control options when shopping online on e-commerce platforms:						
Please rate the level of clarity of digital payment services that transparently provide details regarding payment transaction reports and users to see details of transaction fees, or commissions when shopping online on E-commerce platforms:	Q14	5	23	120	47	0
Please rate the level of clarity of digital payment services that provide easily accessible status information and transaction history and send transaction status notifications and payment confirmations in real-time when shopping online on E-commerce platforms:	Q15	1	3	19	116	56

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