A Study on Public Perception on the Adoption of Central Bank Digital Currency (CBDC) in Ireland

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MSc Project Submission Sheet

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Programme:	……… MSc Fintech……………………………………… **Year:** …2021/2022……….
Module:	……… Research Project ……………………………………………………..………
Supervisor: Submission Due Date:	………… Noel Cosgrave ………………………………………………..………
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Configuration Manual

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1   Introduction

As a requirement for submission of the research paper titled – "A Study on Public Perception on the Adoption of Central Bank Digital Currency in Ireland", the system requirements and steps required for reproducibility of the analysis conducted in the study are described in this configuration manual.

2   System Requirements

2.1 Hardware
- Device name: LAPTOP-44GVDUO3
- Processor: 11th Gen Intel(R) Core(TM) i5-1135G7 @ 2.40GHz   2.42 GHz
- Installed RAM: 8.00 GB (7.77 GB usable)
- System type: Windows 11, Home 64-bit operating system, x64-based processor

2.2 Software

- Rstudio: R programming language and RStudio (2021.09.0+351 "Ghost Orchid" Release) for Windows were used to perform the following statistical techniques: Descriptive Statistics, Chi-square Test, Cronbach's Alpha Test and Factor Analysis.
- Microsoft Excel 2018: the data was extracted into a format readable by Excel – CSV. For obtaining frequencies, the data was transposed in Excel and the countif() function was used.
- Google Forms: the survey questions were deployed using this tool.

3   Data
- The research focused on primary data, obtained using an electronic questionnaire deployed via Google forms.

4   Analysis

4.1 Install Packages
- library(dplyr): this allows data to be easily manipulated.
- library(skimr): this provides summary statistics.
- library(psych): useful for Cronbach's Alpha test.
- library(readxl): this allows excel files to be easily readable.

- library("FactoMineR"): useful for multivariate factor analysis.
- library("factoextra"): useful for multivariate data visualisation.
- library(visdat): useful for missing data visualisation.
- library(corrplot): useful for plotting correlation among variables.
- library(ggplot2): useful tool for visualisation.
- library(gridExtra): extends the grid systems.
- library(grid): supports the grid system by allowing objects to be manipulated.

4.2 Data Preparation

- Import Dataset

> Survey <- read.csv("A Study on Public Perception on the Adoption of Central Bank Digital Currency in Ireland.csv", header=T, na.strings=c(" "), stringsAsFactors = T)

- Removal of unwanted columns from the dataset
  - o The timestamp column was removed since it is not useful for the purpose of the study.

- Checking for missing values
  - o The vis_miss() function was used to ascertain the degree of data missingness.

- Renaming Columns and Rows
  - o All column names following the demography-based questions were group based on the UTAUT model and the perception of CBDC trust drivers for visualisation purposes and ease of referencing.
  - o Where: KWL = Knowledge; EE=Effort Expectancy; FC=Facilitating Conditions; PE=Performance Expectancy; TR=Trust; and IB=Behavioral Intention.

```
colnames(Data)[7:9] <- paste("KWL", 1:3, sep="")
colnames(Data)[10:11] <- paste("EE", 1:2, sep="")
colnames(Data)[12:13] <- paste("FC", 1:2, sep="")
colnames(Data)[14:15] <- paste("SI", 1:2, sep="")
colnames(Data)[16:17] <- paste("PE", 1:2, sep="")
colnames(Data)[18:22] <- paste("TR", 1:5, sep="")
colnames(Data)[23:30] <- paste("IB", 1:8, sep="")
```

- The row names containing 'Prefer not to say' under Marital Status and Education were renamed for uniqueness, to resolve an error code. Also, the first five responses under column name 'County' were renamed.

```
Data[9, "Marital.Status"] <- "PNTS"
Data[16, "Marital.Status"] <- "PNTS"
Data[9, "Education"] <- "PNTS1"
Data[20, "Education"] <- "PNTS1"
Data[47, "Education"] <- "PNTS1"
Data[59, "Education"] <- "PNTS1"
Data[66, "Education"] <- "PNTS1"
Data[82, "Education"] <- "PNTS1"
Data[1:5, "County"] <- "Unspecified"
```

4.3 Data Analysis

4.3.1   Mean and Standard Deviation
- The skim() function in R was used.

4.3.2   Frequency
- This was obtained using excel. The results were transformed and the Countif() function was used

4.3.3   Chi-square Test
- A new data frame – 'chisqrdata' was created for recallability purpose.
- Responses under the categorical variables (Age, Gender, Education and Occupation) were converted to characters using as.character(), assigned numbers and converted to factors.
- The chisq.test() function in R was used.

4.3.4   Cronbach's Alpha
- New data frames were created based on the what each questions relate to under the UTAUT model.
- The function psych::alpha() was used to obtain the results.

4.3.5   Factor Analysis
- Bartlett's Test of Sphericity
  o A new data frame was created without the demographic data, as the test can only be performed on values.
  o The cor() function in R was used. Also, the correlation between the variables was plotted using the corrplot() function.

- KMO Test using the kmo() function.

- The FAMD() function in R for mixed data was initially adopted for the factor analysis.

- Scree plot (side-by-side).

```
a <- fviz_eig(res.famd,
        choice='eigenvalue',
        geom='line')
b <- fviz_eig(res.famd)
grid.arrange(a, b, ncol=2)
```

- Justification for using three (3) factors based on parallel analysis

```
parallel <- fa.parallel(Data)
```

- Obtaining the FAMD results
  o A new dataframe was created

```
var <- get_famd_var(res.famd)
```

o Factor analysis results (using contributions)

```
> # Contributions to the  dimensions
> var$contrib
                    Dim.1         Dim.2        Dim.3
KWL1           3.27141223  0.011961037  17.182720162
KWL2           3.23333720  0.021907313  14.002841666
KWL3           2.53442883  0.086572607  10.911761451
EE1            3.73444923  2.324043468   0.200295853
EE2            4.23393742  3.214747123   0.001578646
FC1            3.46659073  3.137941868   0.885539250
FC2            5.53735786  3.357584672   0.002357324
SI1            2.70793624  0.619202608   0.982429121
SI2            1.99035331  0.345948997   2.405808838
PE1            4.21329972  3.381234371   0.248735390
PE2            4.82221848  5.525579422   1.323104642
TR1            4.97509726  5.494252651   0.048373129
TR2            4.48007539  6.071881163   1.846189789
TR3            3.58431415  4.294446906   2.422988197
TR4            3.59855623  0.488359717   1.746682931
TR5            4.08903883  4.152004228   0.714410631
IB1            4.74117706  2.090380673   0.112133979
IB2            4.38327864  4.995333186   1.037094066
IB3            3.56579159  9.149053369   0.032173353
IB4            5.74586497  2.933219579   0.728175891
IB5            4.46371130  5.976171409   1.306547601
IB6            4.16765180  6.032328816   0.489249511
IB7            4.31577839  9.346238342   0.124623120
IB8            4.52511136  9.325712672   0.050296148
Gender         0.02582640  0.006914682   0.934461769
Age            0.19803918  2.635977917   5.686510707
Marital.Status 0.40129596  0.586223274   5.191605608
Education      1.16180936  0.615381594   8.704093036
Occupation     0.07878292  0.505559463   4.354675460
County         1.75347795  3.273836874  16.322542734
```

Fig:1 FAMD results for three factors based on contributions

- FAMD results proved to be difficult to interpret. The fa() function using the varimax rotation was adopted for ease of interpretability. The fa method only considers numerical values, as such the categorical data were not considered for further analysis.
    o Varimax rotation using the fa method.

```
Result.fa <- fa(r=Test.fa, nfactors = 3, fm="pa", max.iter=100,
```

- Plotting the factor analysis chart

```
fa.diagram(Result.fa, main="Factor Analysis")
```

APPENDIX

Table 1: Questionnaire and Frequency Analysis of Responses

Likert Scale: 1 = Very unlikely, 2 = Unlikely, 3 = Somewhat Unlikely, 4 = Neither likely nor unlikely, 5= Somewhat likely, 6 = Likely, 7 = Very likely;
l = Very Poor, 2 = Poor, 3 = Somewhat poor, 4 = Neither good nor poor, 5= Good, 6 = Very good, 7 = Excellent;
1 = Strongly Disagree, 2 = Disagree, 3 = Somewhat Disagree, 4 = Neither Agree nor Disagree, 5 = Somewhat Agree, 6 = Agree, and 7 = Strongly Agree.

Where: KWL = Knowledge; ; EE=Effort Expectancy; FC=Facilitating Conditions; PE=Performance Expectancy; TR=Trust; and IB=Behavioral Intention.

Questions	Abbr.	1	2	3	4	5	6	7
Rate your understanding of the term digital currency.	KWL1	0	8	10	30	36	30	30
Rate your knowledge of how a digital currency works.	KWL2	1	9	22	24	40	28	20
Rate your understanding of what a central bank digital currency is.	KWL3	3	12	24	30	35	26	14
Please rate the importance of being able to learn and understand the central bank digital currency (CBDC) system.	EE1	2	2	4	18	29	43	46
Please rate the importance of ease of use of a CBDC system.	EE2	2	3	9	16	27	40	47
Please rate the importance of accessing help with using the CBDC.	FC2	1	2	5	18	26	48	44
I will use the CBDC if those in a position of influence suggest that it should be done	SI1	0	5	7	35	34	34	29
I will use the central bank digital currency system if my family and close friends suggest that I do.	SI2	3	7	10	31	27	42	24
To what extent is ease of performing transactions important in the uptake of CBDC.	PE1	1	1	2	25	26	43	46
To what extent is the speed of transactions important in the uptake of CBDC.	PE2	1	0	3	14	27	41	58
To what extent is trustworthiness important in the adoption of a CBDC.	TR1	0	1	5	17	17	21	83
To what extent is security important in the adoption of a CBDC.	TR2	1	0	3	13	11	30	86
To what extent is transaction reversibility important in the adoption of a CBDC.	TR3	1	4	5	12	18	37	67
To what extent is anonymity important in the adoption of a CBDC.	TR4	1	3	12	22	32	37	37
To what extent is privacy important in the adoption of a CBDC.	TR5	0	1	4	14	18	36	71

Questions	Abbr.	1	2	3	4	5	6	7
To what extent would you use CBDC compared to an unregulated currency such as Ethereum or Bitcoin.	IB1	3	10	6	37	29	34	25
To what extent do you think using a CBDC will require access to the Internet.	FC1	2	2	9	15	23	34	59
Once the central bank digital currency is launched, I will always use it	IB2	3	10	11	41	38	24	17
I will convert most of my bank deposits into the central bank digital currency when it becomes available.	IB3	9	15	16	40	33	18	13
I intend to use the central bank digital currency system for cross-border payments.	IB4	5	3	14	37	43	25	17
I will use the central bank digital currency system for person-to-person transactions.	IB5	3	10	6	25	52	34	14
I will use the central bank digital currency system for my shopping.	IB6	7	7	11	28	46	29	16
I intend to use the central bank digital currency system to receive my salary.	IB7	7	15	18	32	32	24	16
I prefer to be paid for my personal services via the central bank digital currency system.	IB8	8	11	23	37	26	26	13

Codes References:

Ahn, D., (2021). Exploratory Factor Analysis in R. [online] Medium. Available at: <https://towardsdatascience.com/exploratory-factor-analysis-in-r-e31b0015f224> [Accessed 14 August 2022].

Alboukadel, K., (2017). FAMD - Factor Analysis of Mixed Data in R: Essentials - Articles - STHDA. [online] Sthda.com. Available at: <http://sthda.com/english/articles/31-principal-component-methods-in-r-practical-guide/115-famd-factor-analysis-of-mixed-data-in-r-essentials/> [Accessed 12 August 2022].