Digital rupiah: Are Indonesians ready?

Kharisma Dwi Widodo[a*], Bambang Juanda[b], Dwi Setyowawan[b], Dinda Lutfiyah[b]
[a]*Directorate of Distribution Statistics, Badan Pusat Statistik, Indonesia*
[b]*Faculty of Economics and Management, IPB University, Indonesia*

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Abstract

Bank Indonesia has attempted to calibrate its policy approach to adopting a Central Bank Digital Currency (CBDC) called Rupiah Digital through the Garuda project, as an effort to address the issue of shadow banking that has developed into a shadow currency issue and even a shadow central banking issue. This study aims to determine the characteristics of digital banking users in Indonesia regarding the use of Central Bank Digital Currency (CBDC). This study was examined using panel data regression analysis and then confirmed using Structural Equation Model-Partial Least Structural (SEM-PLS) analysis. The results show that socioeconomics (digital use), digital literacy, digital access, and digital security influence CBDC implementation in Indonesia. Furthermore, Indonesian society is ready to accept and use CBDC (r-CBDC). However, the implementation must be gradual because socioeconomics (digital use), digital literacy, digital access, and digital security in Indonesia are not evenly distributed and are still centered on the island of Java.

Keywords: central bank digital currency; nudge theory; panel data regression; SEM-PLS

JEL Classification: E41; E42; E58

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*Corresponding Author: kharisma.bps@gmail.com

1. Introduction

At the end of 2022, Bank Indonesia published the White Paper of Project Garuda as an initial step toward accelerating the digital transformation in adopting Indonesia's Central Bank Digital Currency (CBDC), named Rupiah Digital (Bank Indonesia, 2023). Bank Indonesia is currently exploring two types of Rupiah Digital: retail (r-CBDC) and wholesale (w-CBDC), with the main features of card-based and account-based systems for r-CBDC and token-based systems for w-CBDC (Juanda et al., 2022). Rupiah Digital is seen as a sustainable, future-proof solution that addresses the limitations of existing fiat money, positioning itself as a core instrument for the central bank in fulfilling its mandate in the digital era.

The issuance of Rupiah Digital is part of Bank Indonesia's response to the growing prevalence of private digital currencies such as crypto assets and stablecoins issued by non-bank financial institutions. At the same time, Bank Indonesia (2022) recorded a 57.74% increase in e-payment transaction value in 2021 compared to 2020, while cash transactions continued to decline. The widespread use of privately managed, unlicensed cryptocurrencies poses significant risks, potentially threatening national monetary sovereignty, as governments may lose control over monetary policy. This digital disruption has moved beyond the issue of shadow banking and has evolved into concerns over shadow currency and even shadow central banking (Bank Indonesia, 2022).

However, implementing Rupiah Digital (CBDC) is not an easy task for the central bank. According to Boar et al. (2020) the success of CBDC adoption is highly dependent on each country's economic structure and payment systems, implying that "there's no one-size-fits-all" approach. Indonesia, currently in a demographic bonus period, has the opportunity to accelerate the transformation of digital banking. Nevertheless, as an archipelagic nation with an area of 1.9 million square kilometers, Indonesia faces serious challenges in terms of accessibility and digital infrastructure. Therefore, Bank Indonesia must carefully design the Rupiah Digital (CBDC) to balance benefits with risk management and ensure that its implementation aligns with the characteristics and readiness of the Indonesian people as end users. Based on the above background, the main research questions to be studied include:

1. What factors influence the use of Digital Rupiah (CBDC) in Indonesia?
2. What are the characteristics of digital banking users in Indonesia regarding their use of Digital Rupiah (CBDC)?

Unlike previous studies, such as Juanda et al. (2022), who examined the design of Indonesia's CBDC, and Widianti (2023), Setyowawan (2023), and Widodo et al. (2024), who analyzed the factors influencing CBDC adoption from the perspectives of demographics, accessibility, and infrastructure, this study expands on the digital banking discourse found in earlier research by Ngo et al. (2022), Jabbar et al. (2020), Bayu (2019), and Akmaliyah (2017).

Additionally, it builds upon the dynamic modeling approaches used by Juanda et al. (2023) and Widodo et al. (2023), who examined CBDC design from the standpoint of economic actors' preferences in Indonesia. This study introduces a novel analytical approach by elaborating on panel data regression models and Structural Equation Modeling - Partial Least Squares (SEM-PLS) to assess the characteristics of digital banking users that influence the implementation of Rupiah Digital (CBDC) in Indonesia.

Indonesia's readiness to implement a Central Bank Digital Currency (CBDC) remains a critical concern, as this topic is still relatively new and underexplored in the national context, with limited academic and policy references available. This research aims to fill that gap by focusing on four key determinants of Indonesia's preparedness: digital literacy, digital use, digital access, and digital security.

These dimensions serve as foundational pillars for supporting effective and inclusive CBDC adoption, especially amid the rapid digitalization of the financial system. By mapping Indonesia's strengths and weaknesses in these four areas, this study is expected to serve as a strategic reference for policymakers in crafting an implementation roadmap for CBDC that is responsive, secure, and aligned with the socio-economic conditions of Indonesian society.

2. Methodology

This study utilizes a combination of primary and secondary data. It begins with macro-sectoral data and further develops into micro-level data at the individual level. The secondary data comprises provincial-level banking monetary data (i) from 2020 to 2022 (t), sourced from Statistics Indonesia (BPS), the Ministry of Communication and Information Technology, the Financial Services Authority (OJK), and Bank Indonesia (BI).

The primary data is obtained from key informants such as business actors, industry practitioners, academics, and individuals who have savings accounts and/or use digital banking services. The primary data was collected using a purposive sampling technique (Juanda, 2009), distributed online via Google Forms, targeting at least 200 respondents or ten times the number of variables used in this study (Sugiyono, 2008).

As of this study, the use of the Digital Rupiah (CBDC) in Indonesia is still in the early assessment stage (white paper) by Bank Indonesia. Therefore, the analytical approach is based on previous studies examining the determinants of e-payment usage as a proxy for CBDC, as shown in Juanda et al. (2022), Setyowawan (2023), Widiati (2023), and Widodo et al. (2024).

This proxy is selected due to the similarity in characteristics between e-payment and the proposed CBDC design, which also aligns with the implementation of the Digital Yuan (e-CNY) by the People's Bank of China. The Digital Literacy Index and Digital Use Index represent digital literacy and usage, respectively; the Digital Access Index reflects accessibility and digital infrastructure, while the Digital Security Index represents digital security. The mathematical model for this study is as follows:

$$\boldsymbol{Ln\ CBDC}_{it} = \boldsymbol{\beta}_0 + \boldsymbol{\beta}_1\boldsymbol{Digiliteracy}_{it} + \boldsymbol{\beta}_2\boldsymbol{DigiUse}_{it} + \boldsymbol{\beta}_2\boldsymbol{DigiAcces}_{it} + \boldsymbol{\beta}_3\boldsymbol{DigiSecurity}_{it} + \varepsilon_{it} \quad (1)$$

Description:

Ln_CBDC	= CBDC transactions (using e-payment as a proxy)
Digiliteracy	= Digital Literacy Index
DigiUse	= Digital Usage Index
DigiAccces	= Digital Accessibility Index
DigitalSecurity	= Digital Security Index
β0	= intercept
$\beta_1 - \beta_3$	= Regression coefficients of the observed variables
ε_{it}	= error term
i	= province (34 Provinces)
t	= year (2020-2022)

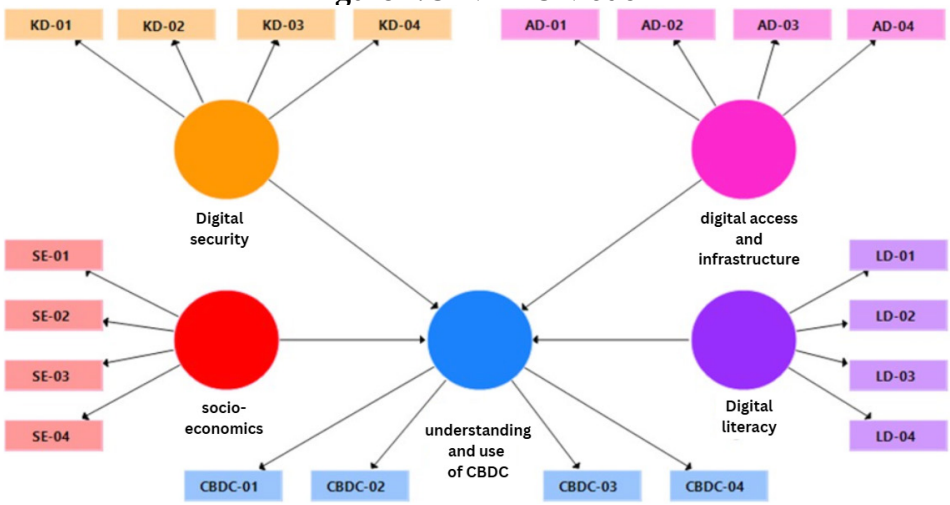
This study applies a panel data model estimation approach, including Common Effect, Fixed Effect, and Random Effect models. It also incorporates further testing, such as the Chow Test, Hausman Test, Lagrange Multiplier Test, and the Best Linear Unbiased Estimator (BLUE) Gauss-Markov assumptions, as well as robustness checks to determine the most consistent and unbiased model.

Primary data collected through the online questionnaire is further analyzed using

the Structural Equation Modeling–Partial Least Squares (SEM-PLS) method to identify the characteristics of digital banking users in Indonesia. The development of the SEM-PLS model, as illustrated in Figure 1, refers to previous studies such as Salsabila (2020), Permadi (2022), and Indryanti (2020), with several adjustments. It also adopts a dynamic model from Juanda (2023) and the Technology Acceptance Model (TAM) as used in Widodo et al. (2023).

The SEM-PLS model in this study employs 20 indicators, divided into: (1) exogenous variables: socio-economic (4 indicators), digital literacy (4 indicators), digital accessibility and infrastructure (4 indicators), and digital security (4 indicators); and (2) an endogenous variable: CBDC Understanding and Usage (4 indicators).

Figure 1. SEM-PLS Model



Types of Models to be Evaluated in SEM-PLS in Figure 1, namely the measurement model (outer model) to assess the relationship between indicators and their latent variables, and the structural model (inner model) to show the relationships among the latent variables being evaluated.

The evaluation of the measurement model (outer model) aims to assess the model's validity and reliability. Several conditions must be met for the model to be suitable for the next stage of research. The tests conducted on the measurement model include: (1) Convergent Validity, based on a loading factor value ≥ 0.5 according to Haryono (2016) and an Average Variance Extracted (AVE) value > 0.5 according to Hair et al. (2021); (2) Discriminant Validity, indicated when the correlation value in the cross-loading for each indicator is higher than its cross-loadings on other constructs, according to Solimun et al. (2017); (3) Composite Reliability, used to test the validity and reliability of the model, where the model is considered valid and reliable if the value is greater than 0.7 according to Solimun et al. (2017), and the Cronbach's alpha value is above 0.6 according to Garson (2016).

The evaluation of the structural model (inner model) aims to assess how well the structural model used by the researcher can mathematically explain the relationships among variables and their indicators (Hair et al., 2020). The evaluation is conducted using three measurement criteria: (1) R-Square (R^2) value to measure the magnitude of influence of exogenous variables on their endogenous variables, categorized into three levels: strong (0.67), moderate (0.33), and weak (0.19) (Ghozali, 2014); (2) Predictive Relevance (Q^2) to determine the predictive strength of the structural model on the observed endogenous variables (Chin, 1998), with the formula:

$Q^2 = 1 – (1 - R^2_1)(1 - R^2_2)...(1 - R^2_n)$ (2)

Description:

Q^2 = Predictive Relevance

R1-Rn = R-Square coefficients of the observed variables

(3) Goodness of Fit (GoF) as a single measure to validate model performance, used to assess the overall fit between the measurement model and the structural model. The criteria are: 0.1 (small GoF), 0.25 (moderate GoF), and 0.36 (large GoF) (Wetzels et al., 2009), calculated as the square root of the product of the average AVE value and the average R^2 value of the model; (4) Path Coefficients, used to examine the influence among latent variables and to test hypotheses, indicated by the significance value of the t-statistic and the parameter coefficient obtained from bootstrapping results (Abdillah and Jogiyanto, 2015).

3. Results and Discussion

To address the research objective regarding the readiness of digital banking users for the implementation of Digital Rupiah (CBDC) in Indonesia (Bank Indonesia, 2023), the analysis was conducted in two stages: (1) Identifying the determinants of Digital Rupiah (CBDC) usage through an econometric approach using panel data regression analysis based on secondary data; (2) The results were then confirmed by supporting analysis from primary data obtained through an online survey using the Structural Equation Model - Partial Least Squares (SEM-PLS) to examine the characteristics of digital banking users.

The panel data regression analysis in this study employs the Weighted Least Squares method, or Generalized Least Squares (GLS), to address violations of regression assumptions (Gauss-Markov theorem), thus producing a regression model that meets the BLUE (Best Linear Unbiased Estimator) criteria. Based on the results of model suitability tests (Chow test, Hausman test, and Lagrange Multiplier test). the best-fitting model selected was the Fixed Effect Model.

Table 1. Panel Data Regression Results

e-Payment		Coefficient	Probability
C		-0.638	0.178
Digital Literacy		0.392	0.000***
Digital Acces		0.152	0.011**
Digital Use		0.352	0.000***
Digital Security		-0.235	0.000***
R-Squared	0.434	Prob (F-statistic)	0.000

Source: processed by the authors.

Note: *** p<0.01, ** p<0.05, * p<0.1.

From Table 1, the overall R-squared value of 0.434 indicates that e-payment (Digital Rupiah/CBDC) can be explained by variability in the independent variables by 43.40 percent at a 95 percent confidence level. The variables influencing digitalization are digital literacy, digital access, digital security, and digital use.

Digital literacy, digital access, and digital use have a positive and significant effect, while digital security has a negative and significant impact. To complement the information presented in the previous section, an additional analysis was conducted using the

Structural Equation Model - Partial Least Squares (SEM-PLS) method with primary data collected via an online questionnaire.

Table 2. Relationship Between Duration of e-Payment Use and Respondents' Education Level

Duration of Use	Education					Total
	High School	Diploma	Bachelor's Degree	Master's Degree	Doctorate Degree	
< 3 Year	27 (50.94)	4 (7.55)	16 (30.19)	3 (5.66)	3 (5.66)	53 (100.00)
3 s/d 5 Year	31 (20.39)	13 (8.55)	47 (30.92)	43 (28.29)	18 (11.84)	152 (100.00)
6 s/d 8 Year	4 (12.50)	1 (3.13)	13 (40.63)	13 (40.63)	1 (3.13)	32 (100.00)
> 8 Year	0 (0.00)	0 (0.00)	5 (38.46)	7 (53.85)	1 (7.69)	13 (100.00)
Total	62 (24.80)	18 (7.20)	81 (32.40)	66 (26.40)	23 (9.20)	250 (100.00)

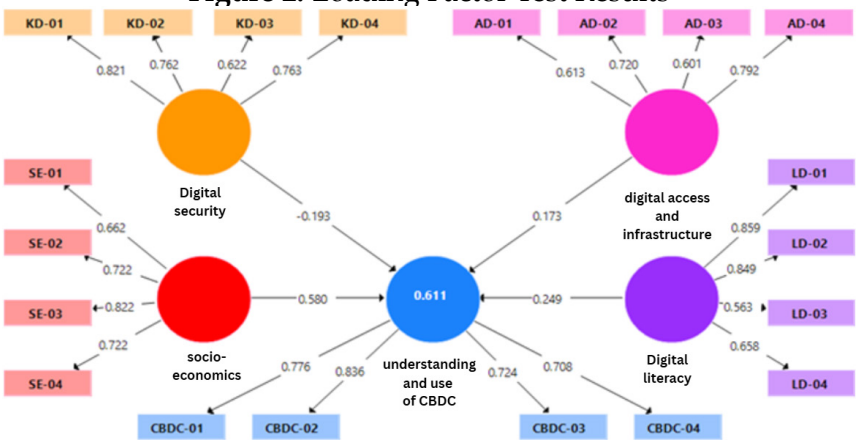
Source: Online Questionnaire Data (Processed)

The online questionnaire, created using Google Forms, was distributed in stages to 384 individuals starting from July 10, 2024. As of August 2, 2024, a total of 250 responses were received, resulting in a response rate of 65.10 percent. The number of respondents exceeded the target and the minimum requirement for data analysis, which was 200 respondents.

The respondents also represented a wide range of educational backgrounds, occupations, and income levels. Moreover, the sample in this study is considered of higher quality and more representative, as the majority of respondents have at least a bachelor's degree and have been long-time users of digital banking and/or e-payment services.

In the Convergent Validity test, each indicator has a loading factor greater than 0.5, indicating that each latent variable reflects more than 50 percent of its respective indicators (Table 2). This means that the measurement instrument developed is appropriate, as it effectively measures the latent variables. The complete results of the SEM-PLS analysis are presented in Figure 2.

Figure 2. Loading Factor Test Results



Source: Online Questionnaire Data

The output of the Average Variance Extracted (AVE) values shown in Appendix Table 3 indicates that all latent variables have AVE values above 0.5. This suggests that the model is acceptable, as convergent validity has been achieved. The output of the Discriminant Validity test shown in Appendix Table 4 demonstrates that the cross-loading values of all indicators are higher on their respective latent variables compared to other latent variables.

Therefore, it can be concluded that the model meets the criteria for discriminant validity. The values of composite reliability and Cronbach's alpha in Appendix Table 3 show that all latent variables have composite reliability values greater than 0.7 and Cronbach's alpha values above 0.6. Thus, it can be concluded that the validity and reliability of the variables are fulfilled. Validity refers to the measurement instrument being appropriate and capable of accurately measuring the intended latent variables, while "reliable" refers to the instrument having a high level of consistency.

The evaluation of the structural model (inner model) aims to examine the relationships among latent variables as formulated in the research hypotheses. From the data processing results, several metrics were obtained: the coefficient of determination (R^2), Predictive Relevance (Q^2), and the Goodness of Fit (GoF) value.

The R-Square (R^2) value reflects the extent to which exogenous variables influence endogenous variables. The independent (exogenous) variables include: socio-economic factors, digital literacy, digital accessibility and infrastructure, and digital security; while the dependent (endogenous) variables include: understanding and usage of CBDC.

The Adjusted R-Square values for the endogenous variables understanding and usage of CBDC indicate that they are influenced by the factors in this study by 60.50%, with the remaining 39.50% influenced by other variables outside the scope of this research.

Predictive Relevance (Q^2) is used to assess the predictive strength of the structural model on observations of the endogenous variables. The calculation result shows a predictive relevance value of 0.605 or 60.50%, indicating that the model is well-constructed and has good predictive relevance.

Goodness of Fit (GoF) is used to evaluate the overall quality of the model. The calculation results show a GoF value of 0.57 (large), indicating that the model is well-fitted and has strong explanatory power.

The relationships among variables in this study are analyzed using a significance test, with a confidence level of 95% (significance level of 0.05). Hypothesis testing is conducted through bootstrapping analysis of the path coefficients. A hypothesis is accepted if the t-statistic value exceeds the t-table value at a 5% significance level. The path coefficient values obtained from the bootstrapping test are presented in Table 4.

Table 3. Output Results of Path Coefficient Values

Path Coefficient	Original Sample	t-Statistic	p-Values	Sig
Socioeconomic → CBDC	0.580	7.236	0.000	Significant
Digital Literacy → CBDC	0.249	3.464	0.001	Significant
Digital Access & Infrastructure → CBDC	0.173	2.721	0.007	Significant
Digital Security → CBDC	-0.193	4.020	0.000	Significant

Source: processed by the authors.

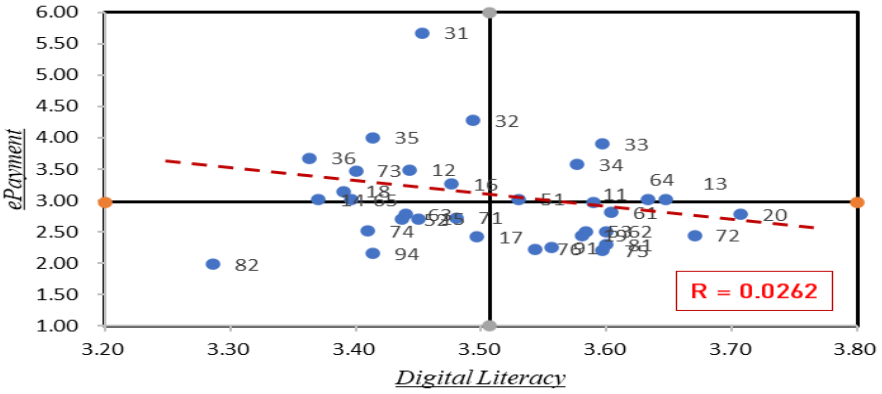
As shown by the analysis results in Table 3 reflecting respondents' preferences in this study, socio-economic factors, digital literacy, access, and infrastructure have a positive and significant influence on the understanding and use of CBDC. However, digital security has a negative and significant impact.

The findings obtained from secondary data analysis using an econometric approach with panel data regression methods were then confirmed by primary data analysis through an online survey using Structural Equation Modeling - Partial Least Squares (SEM-PLS).

The relationship between e-payment and digital literacy is positive but weak and tends to decline, with a value of 0.0262 (2.62%). Digital literacy was found to have a positive and significant influence, as shown by the results from the panel data regression analysis. This is consistent with the SEM-PLS results obtained from the path coefficient output in Table 4, where the original sample value is 0.249, indicating a positive relationship between the two variables, and the p-value is 0.001, which is smaller than the alpha level of 0.05, indicating statistical significance.

Therefore, it can be concluded that digital literacy has a positive and significant impact on the understanding and use of Digital Rupiah (CBDC). This result implies that an increase in digital literacy among Indonesians will positively affect the enhancement of awareness and adoption of the Digital Rupiah (CBDC) in Indonesia.

Figure 3. Relationship Between e-Payment and Digital Literacy Index



Source: Bank Indonesia (2023) and Ministry of Communication and Information Technology (Kominfo) (2023)

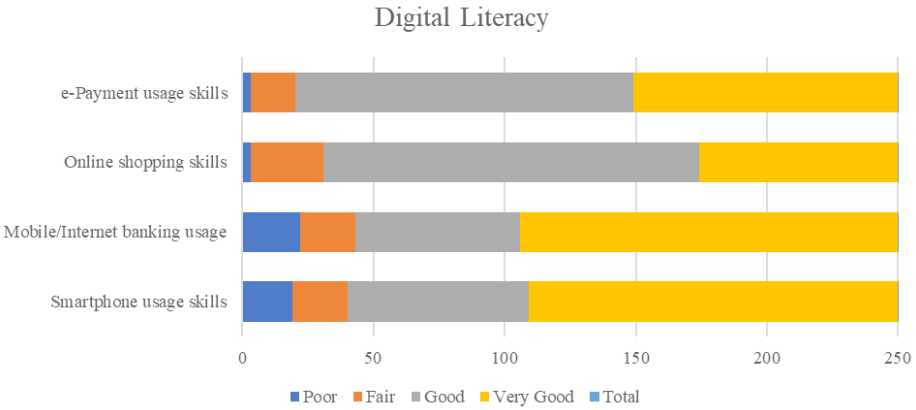
In general, based on Figure 3, digital literacy among Indonesians is increasing. However, digital literacy and e-payment usage are still uneven across the country (Figure 4). Most regions in Indonesia have high digital literacy but low e-payment usage. Only six areas have both high digital literacy and high e-payment usage: (33) Central Java, (34) Yogyakarta (DIY), (51) Bali, (11) Aceh, (64) East Kalimantan, and (13) West Sumatra.

Digital literacy preferences, such as the public's ability to use smartphones, mobile/internet banking, e-payment, and shop online, tend to be very good (46.20%) and good (40.40%). The fact that Indonesians already have strong digital literacy can be seen as both a promising opportunity and a challenge for the implementation of the Digital Rupiah (CBDC) in Indonesia.

The loading factor values for digital literacy shown in Table 4 are, in order: smartphone usage skills (0.859), mobile/internet banking skills (0.849), online shopping skills (0.658), and e-payment usage skills (0.563). This indicates that these indicators should be a key focus for the government and Bank Indonesia in efforts to improve digital literacy as a step toward successful implementation of the Digital Rupiah (CBDC) in Indonesia.

The government and Bank Indonesia must continue to provide education to increase public understanding and use of Digital Rupiah (CBDC) products and services. The more people understand the positive impacts of CBDC, the more likely they are to adopt it.

Figure 4. Digital Literacy Preferences of Indonesian Society



Source: Processed from Online Questionnaire

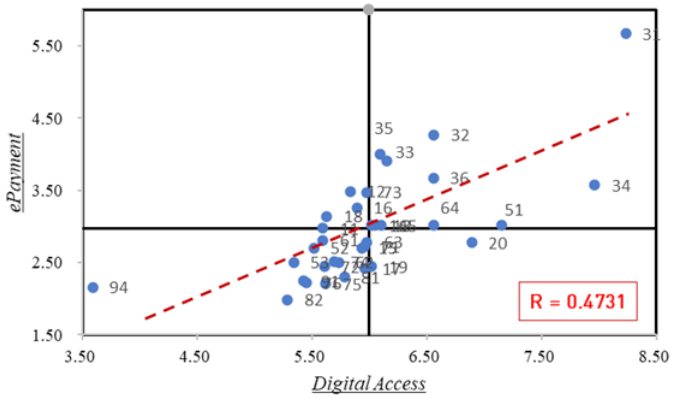
Table 4. Output of Digital Literacy Loading Factor Values

Code	Indicator	Loading Factor
LD-01	Smartphone usage skills	0.859
LD-02	Mobile/Internet banking usage	0.849
LD-03	Online shopping skills	0.658
LD-04	ePayment usage skills	0.563

Source: Online Questionnaire

The relationship between e-payment and digital accessibility and infrastructure is positive, relatively strong, and increasing, with a correlation of 0.4731 (47.31%). Digital accessibility and infrastructure have a positive and significant impact, as shown by the panel data regression results. This is supported by the SEM-PLS output in Table 4, where the original sample value is 0.173, indicating a positive relationship, and the p-value is 0.007, which is below the 0.05 alpha level, indicating significance. Thus, digital accessibility and infrastructure have a positive and significant impact on the understanding and use of the Digital Rupiah (CBDC). This implies that improving digital accessibility and infrastructure across Indonesia can positively influence CBDC adoption.

Figure 5. Relationship Between e-Payment and Digital Accessibility Index



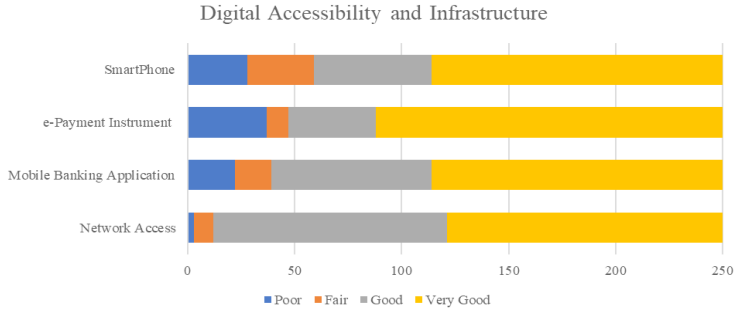
Source: Bank Indonesia (2023) and Kominfo (2023)

While digital accessibility and infrastructure in Indonesia are generally improving, their development and the use of e-payment are still concentrated mainly on the island

of Java (Figures 5 and 6). Most regions in Indonesia still have low digital infrastructure and e-payment usage. Only six provinces show both high digital accessibility and e-payment usage: (31) Jakarta, (32) West Java, (33) Central Java, (34) Yogyakarta (DIY), (35) East Java, and (36) Banten.

Preferences related to digital accessibility and infrastructure such as network access, mobile/internet banking products and services, e-payment availability, and smartphone ownership—are rated as very good (56.30%).

Figure 6. Preferences for Digital Accessibility and Infrastructure in Indonesia



Source: Processed from Online Questionnaire

The loading factor values for digital accessibility and infrastructure shown in Table 5 are, in order: smartphone ownership (0.792), mobile/internet banking services (0.720), network access (0.613), and availability of e-payment instruments (0.601). These indicators should be the focus of the government and Bank Indonesia in their efforts to expand digital access and infrastructure, which are essential for successful CBDC implementation. The easier it is to access the required infrastructure, the more likely the public will adopt CBDC.

Table 5. Output of Digital Accessibility and Infrastructure Loading Factor Values

Code	Indicator	Loading Factor
AD-04	Smartphone ownership	0.792
AD-02	Mobile/Internet banking services	0.720
AD-01	Network access	0.613
AD-03	Availability of e-payment instruments	0.601

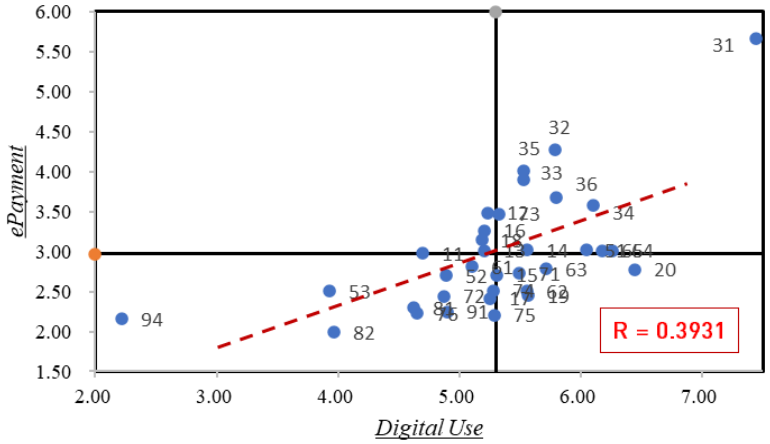
Source: Online Questionnaire

The relationship between e-payment and the digital user aspect is positive, relatively strong, and increasing, at 0.393 (39.3%). Digital user characteristics have a positive and significant influence, as revealed by the panel regression analysis. This aligns with SEM-PLS results where the original sample value is 0.580, indicating a positive relationship, and the p-value is 0.000, showing strong significance.

Therefore, digital user characteristics have a positive and significant impact on the understanding and use of the Digital Rupiah (CBDC). This suggests that an increasing number of digital users, supported by stronger socio-economic conditions, positively influences CBDC adoption in Indonesia.

Digital usage in Indonesia is generally increasing but still concentrated in Java (Figure 7). Most regions still have low digital usage and e-payment adoption, with only six provinces showing both high levels: (31) Jakarta, (32) West Java, (33) Central Java, (34) Yogyakarta (DIY), (35) East Java, and (36) Banten.

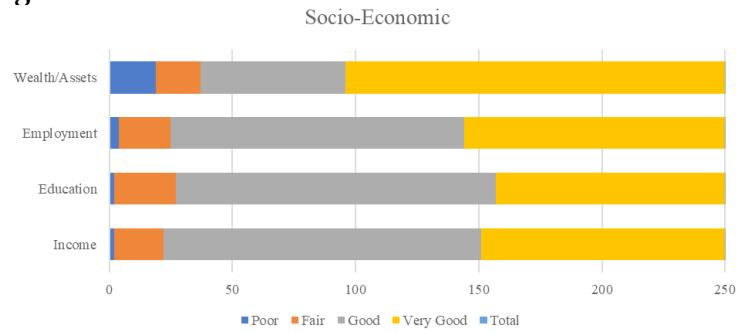
Figure 7. Relationship Between e-Payment and Digital Use Index



Source: Bank Indonesia (2023) and Kominfo (2023)

Digital user characteristics are closely related to Indonesia's socio-economic conditions. These include income, education, employment, and asset ownership, which are generally rated as very good (45.20%) and good (43.70%). This socio-economic strength is a strong indicator of opportunity for CBDC implementation (Figure 8).

Figure 8. Socio-Economic Preferences of Indonesian Society



Source: Processed from Online Questionnaire

The socioeconomic factors loading values shown in Table 6 are, in order: type of employment (0.822), education (0.722), wealth/assets (0.722), and income (0.662). Therefore, it can be concluded that this indicator can be the focus of attention of the government and Bank Indonesia in their efforts to achieve the successful implementation of the Digital Rupiah (CBDC) in Indonesia in terms of socio-economic aspects (digital users), because the high socio-economic level is in line with high literacy/understanding and use of the Digital Rupiah (CBDC).

These indicators should be the focus of government and Bank Indonesia efforts to ensure the successful implementation of the Digital Rupiah from a socio-economic (digital user) perspective. High socio-economic levels correlate with better understanding and use of CBDC.

The relationship between e-payment and digital security is positive but weak and tends to decline, with a value of 0.1158 (11.58%). However, the digital security aspect has a negative and significant effect, as found in the panel data regression analysis. This is supported by SEM-PLS results, where the original sample value is -0.193, indicating a negative relationship, and the p-value is 0.000, indicating statistical significance.

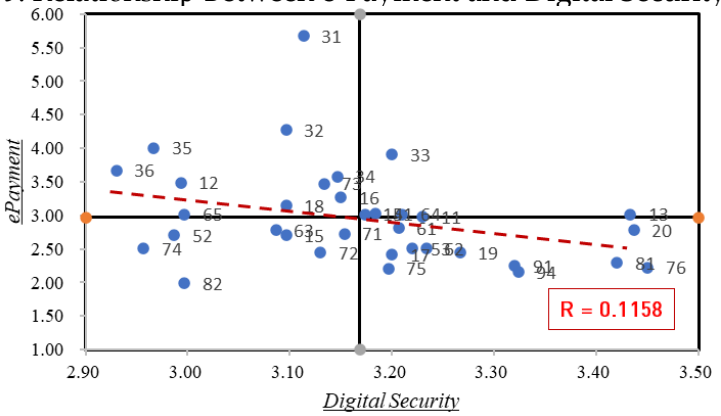
Table 6. Output of Socio-Economic Loading Factor Values

Code	Indicator	Loading Factor
SE-03	Employment	0.859
SE-02	Education	0.849
SE-04	Wealth/Assets	0.658
SE-01	Income	0.563

Source: Online Questionnaire

It can be concluded that digital security has a negative and significant impact on the understanding and use of the Digital Rupiah (CBDC). This suggests that issues such as cyberattacks, data privacy, data security, and fraud prevention are critical. As digital security risks increase, public trust in using CBDC decreases.

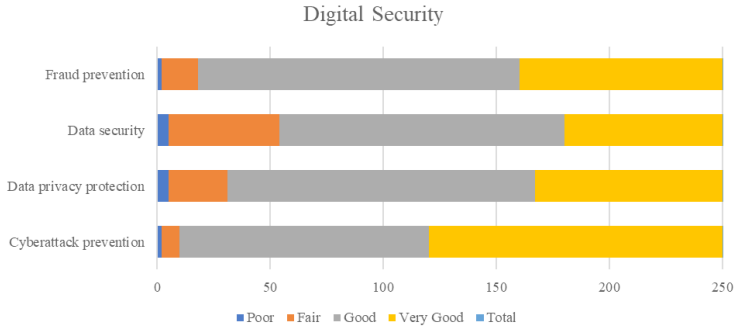
Figure 9. Relationship Between e-Payment and Digital Security Index



Source: Bank Indonesia (2023) and Kominfo (2023)

In general, digital security in Indonesia tends to decline and remains uneven (Figure 9). Most areas show both low digital security and low e-payment usage. Only Central Java is in quadrant 1, with relatively high digital security and e-payment usage. Public awareness of digital security is generally good (51.40%). The ability to recognize and prevent threats such as cyberattacks, data privacy breaches, and fraud is relatively high among Indonesians.

Figure 10. Digital Security Preferences of Indonesian Society



Source: Processed from Online Questionnaire

The loading factor values for digital security, shown in Table 8, in order, are: cyberattack prevention (0.821), fraud prevention (0.763), data privacy protection (0.762), and data security (0.622). Based on these results, it can be concluded that these indicators should be a key focus for the government and Bank Indonesia in enhancing awareness and vigilance regarding digital security as part of the efforts to ensure the successful implementation of the Digital Rupiah (CBDC) in Indonesia (Figure 10).

The government and Bank Indonesia must remain vigilant in protecting and preventing cyberattacks, data privacy breaches, data security risks, and fraud. This includes accelerating the development and enforcement of digital security policies, such as protective measures for online identity, data, and digital assets like photos, passwords, and PINs, especially in preparation for the future implementation of the Digital Rupiah (CBDC) in Indonesia.

Table 7. Output of Digital Security Loading Factor Values

Code	Indicator	Loading Factor
AD-01	Cyberattack prevention	0.821
AD-04	Fraud prevention	0.763
AD-02	Data privacy protection	0.762
AD-03	Data security	0.622

Source: Online Questionnaire

The government and Bank Indonesia should prioritize these indicators in enhancing digital security awareness to support successful CBDC implementation (based on Table 7). Continuous efforts are needed to protect against cyber threats and fraud, including improving policies related to online identity, data, and digital asset protection, such as securing photos, passwords, and PINs in preparation for CBDC adoption in Indonesia.

4. Conclusion

The results of the analysis and discussion regarding the characteristics of digital banking users in Indonesia in relation to the use of the Digital Rupiah (CBDC), as presented in the previous section, are elaborated here into a unified conclusion and recommendations. These conclusions and recommendations aim to serve as references and considerations for Bank Indonesia in calibrating its policy approach for implementing the Digital Rupiah (CBDC), particularly from the perspective of digital banking users in Indonesia.

The study on the factors influencing the use and understanding of CBDC from the viewpoint of digital banking users in Indonesia concludes that the adoption of the Digital Rupiah (CBDC) is influenced by four main factors: (1) Digital literacy – representing digital capability and understanding; (2) Digital access – representing accessibility and digital infrastructure; (3) Socio-economic factors – representing aspects of digital use; (4) Digital security – representing digital safety and protection.

The results of the panel data regression analysis using the Generalized Least Squares (GLS) method show an Overall R-squared value of 0.4340, indicating that e-payment (Digital Rupiah/CBDC) is explained by 43.40% of the variability in the independent variables with a 95% confidence level.

Digital literacy, digital access, and digital use have positive and significant influences, whereas digital security has a negative and important influence. These findings are consistent with the survey-based analysis using the Structural Equation Model - Partial Least Squares (SEM-PLS) method. Public preferences, represented by socio-economic

variables, digital literacy, access, and infrastructure, also positively and significantly influence understanding and use of the CBDC.

In contrast, digital security has a negative and significant influence. The Adjusted R-Squared value of 60.50% indicates that understanding and use of the Digital Rupiah (CBDC) can be explained by the independent variables by 60.50% at a 95% confidence level. At the same time, the remaining variance is due to other factors not included in this study.

In general, digital literacy, digital access, and digital use in Indonesia have shown upward trends from 2021 to 2022, except for digital security, which has tended to decline. The correlation values between digital literacy, digital access, digital use, and digital security with e-payment usage are positive and increasing. However, this development is still uneven, with a concentration in Java Island compared to other regions. The findings indicate that the Indonesian public is ready to accept and use the CBDC (r-CBDC).

However, its implementation should be gradual, considering that socio-economic (digital use), digital literacy, digital access, and digital security are still unevenly distributed and concentrated mainly in Java. Although Indonesians already demonstrate reasonably good levels of digital literacy, access, use, and security, these aspects present a potential opportunity for the successful implementation of the Digital Rupiah (CBDC) in Indonesia.

That said, digital security, which has a negative and significant effect, must be a key focus and ongoing challenge for the government and Bank Indonesia in enhancing digital safety awareness to ensure the success of the CBDC implementation.

The government and Bank Indonesia must remain vigilant in protecting against and preventing cyberattacks, data breaches, privacy violations, and fraud by accelerating policies on digital security. This includes measures to protect online identities, data, and digital assets such as photos, passwords, and PINs, especially in preparation for the upcoming implementation of the Digital Rupiah (CBDC) in Indonesia.

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