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# Employing the Technology Readiness Index (TRI) to Evaluate Customer Readiness for Future Adoption of The Metaverse in Virtual Branch Digital Banking Services.

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***Abstract*— Metaverse banking integrates traditional financial services within a virtual environment, enabling alternative transaction channels through augmented reality (AR) and virtual reality (VR). By 2030, it is projected that nearly all bank clients will utilize these technologies for banking transactions. Although existing studies have explored metaverse adoption, there remains a significant research gap regarding client readiness for this transition. This study addresses this gap by examining customer readiness for metaverse banking using a quantitative approach. Data were collected through questionnaires distributed to 100 respondents in Bengkulu, Indonesia, and analysed using the Technology Readiness Index (TRI) and SmartPLS 4 software. The findings indicate that customers in Bengkulu exhibit a readiness for virtual digital banking services in the metaverse, with a TRI score of 2.37 among respondents in the low technology readiness category. This score reflects a generally optimistic and innovative attitude toward metaverse banking, although accompanied by concerns about technological security. The "Innovative" component within the TRI showed a significant impact on potential metaverse technology adoption, suggesting that users are willing to independently explore and adopt this technology. This study contributes to the understanding of client preparedness and potential adoption of metaverse banking, highlighting both the enthusiasm and reservations held by prospective users.***

***Keywords*— Technology Readiness Index, TRI, Metaverse, Virtual Branch***

## I. INTRODUCTION

Information and Communication Technology (ICT) encompasses not only hardware and software but also brainware, or human resources. The success of implementing or adopting new technology, particularly the ICT in an organization, largely depends on the readiness of brainware—specifically, the users of ICT, both internal and external. Technical factors like hardware and software are generally straightforward to address; if they malfunction, they can easily be replaced, repaired, or procured anew. However, issues related to brainware are extraordinarily complex, as each individual carries their own mental map, which often results in conflicting or clashing perspectives.

The development of metaverse technology has introduced immense potential, especially in the banking sector, with virtual branches that can overcome geographical constraints. The metaverse platform has the potential to revolutionize the banking industry by enhancing customer communication and enabling secure, seamless transactions [1]. A study on metaverse adoption titled "Exploring Metaverse-Enabled Innovation in Banking: Leveraging NFTs, Blockchain, Contracts for Transformative Business Opportunities" suggests a research gap, noting, "Exploratory studies can further investigate the nuances of customer behavior in metaverse banking or the role of regulators in this new dimension" [2]. Another study, "Metaverse Banking Service: Are We Ready to Adopt? A Deep Learning-Based Dual-Stage SEM-ANN Analysis," used the Unified Theory of Acceptance and Use of Metaverse Technology as its research model. The study found that the proposed hypothesis between metaverse financial resources (MEF) and behavioral intention to use metaverse banking services (BIM) was unsupported, indicating the need for further investigation. The respondents in this study were experienced metaverse users, totaling 491 participants. This study contributes to academic literature by proposing new constructs to assess the likelihood of users adopting metaverse banking services [3].

The limited scientific research on this topic and the scarcity of studies indicate a lack of comprehensive understanding of the challenges associated with metaverse banking adoption. The research gap identified in this study reflects the limited available information, which hinders our understanding of this phenomenon and restricts efforts to address societal challenges. Expanding research in this domain could yield deeper insights, provide a stronger foundation, and lead to more effective solutions for existing knowledge-related challenges.

Based on the above review, it is evident that while research on metaverse adoption in banking has been conducted, there remain gaps, particularly concerning customer readiness for metaverse adoption in banking. The benefits of metaverse applications in banking appear to contrast with the public's acceptance of this technology. Therefore, further research is needed to examine customer readiness for the potential adoption of metaverse technology in virtual branch digital banking services.

## II. RESEARCH METHOD

This study employs a quantitative approach to measure customer readiness for the potential adoption of metaverse technology in digital banking services. According to [4], quantitative research is a process through which knowledge is acquired by analyzing numerical data to gather detailed information on the topic of interest. Quantitative research methods involve field studies that emphasize numerical data collection. This approach allows the complexity of real-world phenomena to be interpreted through quantifiable figures, facilitating knowledge development and solutions to various issues [5].

The population for this study consists of individuals residing in the city of Bengkulu who have previously used digital banking services (such as mobile or internet banking). The researchers employed a purposive sampling technique, also known as selective or subjective sampling, which involves using the researcher's judgment to select participants [6]. The sampling criteria in this study include:

1. Active users of mobile and internet banking services. This criterion aligns with research focusing on virtual branches and is supported by [7], which states that mobile banking is an online system managed by computer and communication technology, enabling customers to conduct transactions from any branch location.
2. Aged 21–39 years, consistent with [7], which indicates that mobile banking users in Bengkulu are predominantly within this age range.
3. Residing in Bengkulu, aligning with the study's location in the city of Bengkulu.

The researcher established the criterion of including only mobile and internet banking users based on findings from [7]. This study highlights that customers' knowledge regarding banking services is largely influenced by factors such as their access to information about available services from the bank and other easily accessible sources, including television and the internet. Therefore, educational level and occupation are not considered primary factors in determining customers' understanding of banking services. The sample size for this study was calculated using Lameshow's formula, as the population size is unknown or infinite. Lameshow's formula is applied to determine the required sample size for research purposes, using the following formula:

$$n = \frac{z^2 . p(1-p)}{d2}$$

n : Sample

z : Standard value = 1.96

p : Proportion 50% = 0.5

d : Error sampling 10% = 0.10

Based on the above formula, the sample size to be taken is:

$$n = \frac{1{,}96^2 . 0{,}5(1-0{,}5)}{0{,}12}$$

$$n = \frac{3{,}82416 . 0{,}25}{0{,}01}$$

$$n = 96{,}04$$

This study uses a sample size of 100 respondents. The sample size was rounded to 100 to ensure more comprehensive responses; if any responses in one questionnaire are invalid, additional data can be used to maintain reliability. Additionally, this facilitates data processing for the researchers. The distribution of questionnaires to 100 respondents is aimed at measuring the readiness for potential adoption of metaverse technology in virtual branch digital banking services in Bengkulu.

This study employs two data processing methods: the Technology Readiness Index (TRI) test to assess technology readiness scores and Structural Equation Modeling (SEM) based on Partial Least Squares (PLS) using SmartPLS 4. According to [8], Structural Equation Modeling (SEM) is a multivariate statistical technique used to test relationships between variables in a model. PLS-SEM analysis is divided into two models: the Measurement Model (outer model) and the Structural Model (inner model).

Before posing questions to respondents, the researcher included preliminary questions in the questionnaire to assess respondents' understanding. These questions included, "Are you familiar with metaverse technology?" and "Are you familiar with metaverse technology in the banking sector?" Additionally, to provide respondents with a better understanding, the researcher supplied an explanatory video illustrating the concept and technology of the metaverse. If, after viewing the video, respondents still did not understand the concept of metaverse technology, they were asked to exit the questionnaire.

A total of 70 questionnaires were distributed in person, with respondents completing them face-to-face with the researcher. The remaining 30 questionnaires were distributed online. Data collected from these questionnaires were then analyzed using Microsoft Excel, with validity and reliability tests conducted through SmartPLS 4. Further analysis included an evaluation of the measurement model (outer model) and the Technology Readiness Index (TRI) test. The research flow or stages are outlined in Figure 1.

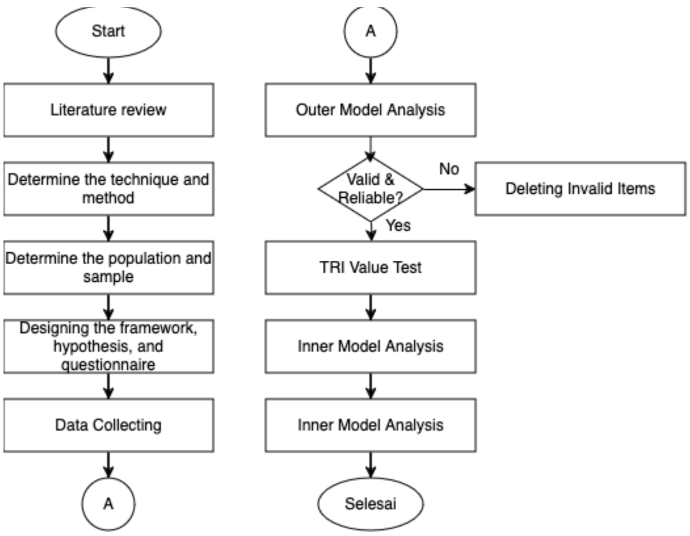


FIGURE 1. Research flow

## III. RESULT AND DISCUSSION

This section presents the data processing results, including statistical data testing based on the distributed questionnaire. The initial step involved conducting an outer model analysis, followed by measurement using the Technology Readiness

Index (TRI) test to assess technology readiness levels. The statistical data testing continued with an examination of the relationships between the four TRI variables across constructs using SEM-PLS data analysis.

A. **Outer Model Analysis**

1. Convergent Validity

TABLE 1. Convergent Validity

| Indicator | Outer Loading | Output |
|---|---|---|
| OPT 1 | 0.896 | *Reliable* |
| OPT 2 | 0.907 | *Reliable* |
| OPT 3 | 0.898 | *Reliable* |
| OPT 4 | 0.903 | *Reliable* |
| INN 1 | 0.831 | *Reliable* |
| INN 2 | 0.911 | *Reliable* |
| INN 3 | 0.901 | *Reliable* |
| INN 4 | 0.855 | *Reliable* |
| DIS 1 | 0.941 | *Reliable* |
| DIS 2 | 0.937 | *Reliable* |
| DIS 3 | 0.925 | *Reliable* |
| DIS 4 | 0.942 | *Reliable* |
| INS 1 | 0.876 | *Reliable* |
| INS 2 | 0.910 | *Reliable* |
| INS 3 | 0.887 | *Reliable* |
| INS 4 | 0.871 | *Reliable* |
| AM 1 | 0.944 | *Reliable* |
| AM 2 | 0.940 | *Reliable* |
| AM 3 | 0.872 | *Reliable* |

The table above presents the results of the convergent validity test at the outer loading stage. It can be observed that the indicators have an outer loading value ⩾ 0.70, indicating that all indicators are valid and reliable. Next, the AVE value test is conducted.

2. Average Variance Extracted (AVE)

TABLE 2. Average Variance Extracted (AVE)

| Variables | *Average Variance Extracted* (AVE) |
|---|---|
| *Optimism* (OPT) | 0.811 |
| *Innovativeness* (INN) | 0.766 |
| *Discomfort* (DIS) | 0.877 |
| *Insecurity* (INS) | 0.786 |
| *Metaverse Adoption* (AM) | 0.845 |

The table above shows that the AVE values for the variables are greater than 0.5. Therefore, it can be concluded that the variables used in the study exhibit good convergent validity [9].

3. Cross Loading

TABLE 3. Cross Loading

| Indicator | AM | DIS | INN | INS | OPT |
|---|---|---|---|---|---|
| **AM 1** | **0.944** | 0.286 | 0.541 | 0.367 | 0.455 |
| **AM 2** | **0.940** | 0.288 | 0.590 | 0.353 | 0.475 |
| **AM 3** | **0.872** | 0.307 | 0.448 | 0.307 | 0.412 |
| **DIS 1** | 0.325 | **0.941** | 0.380 | 0.833 | 0.255 |
| **DIS 2** | 0.283 | **0.937** | 0.349 | 0.778 | 0.192 |
| **DIS 3** | 0.297 | **0.925** | 0.291 | 0.836 | 0.168 |
| **DIS 4** | 0.281 | **0.942** | 0.306 | 0.864 | 0.163 |
| **INN 1** | 0.393 | 0.246 | **0.831** | 0.173 | 0.678 |
| **INN 2** | 0.509 | 0.278 | **0.911** | 0.316 | 0.707 |
| **INN 3** | 0.522 | 0.247 | **0.901** | 0.228 | 0.735 |
| **INN 4** | 0.569 | 0.446 | **0.855** | 0.427 | 0.553 |
| **INS 1** | 0.417 | 0.752 | 0.398 | **0.876** | 0.264 |
| **INS 2** | 0.244 | 0.862 | 0.247 | **0.910** | 0.150 |
| **INS 3** | 0.309 | 0.743 | 0.291 | **0.887** | 0.150 |
| **INS 4** | 0.303 | 0.798 | 0.213 | **0.871** | 0.102 |
| **OPT 1** | 0.385 | 0.164 | 0.664 | 0.148 | **0.896** |
| **OPT 2** | 0.429 | 0.168 | 0.629 | 0.153 | **0.907** |
| **OPT 3** | 0.447 | 0.242 | 0.706 | 0.233 | **0.898** |
| **OPT 4** | 0.486 | 0.180 | 0.724 | 0.178 | **0.903** |

Table 3 presents the results of the cross-loading test. An indicator is considered acceptable if its loading on the measured construct is higher than the loading on other constructs. For instance, the construct AM has a higher loading value compared to the constructs DIS, INN, INS, and OPT. Therefore, it can be concluded that the cross-loading test is acceptable.

4. Reliability Test

TABLE 4. Average Variance Extracted (AVE)

| Variable | *Cronbach's alpha* | *Composite reliability* |
|---|---|---|
| *Metaverse Adoption* | 0.908 | 0.925 |
| *Discomfort* | 0.953 | 0.957 |
| *Innovativeness* | 0.899 | 0.910 |
| *Insecurity* | 0.911 | 0.941 |
| *Optimism* | 0.923 | 0.928 |

The results of the Cronbach's alpha and composite reliability tests can be seen in Table 4 above. Based on Table 4, the Cronbach's alpha and composite reliability values for each variable are greater than 0.70. Therefore, it can be concluded that the research questionnaire indicators have good composite reliability and are reliable in measuring the phenomenon under study.

5. Technology Readiness Index (TRI) Test

The results of the TRI (Technology Readiness Index) test are obtained from the TRI values for each variable. The TRI variable scores are calculated by summing the scores of each individual variable, with the sum representing the overall TRI score.

TABLE 5. Technology Readiness Index Score

| Variable | Score |
|---|---|
| *Optimism* | 0,69 |
| *Innovativeness* | 0,67 |
| *Discomfort* | 0,63 |
| *Insecurity* | 0,38 |

| | |
|---|---|
| **Total** | **2,37** |

The TRI scores for the variables are as follows: the Optimism variable has a score of 0.69, the Innovativeness variable has a score of 0.67, followed by the Discomfort variable with a score of 0.63, and the Insecurity variable with a score of 0.38. The sum of the Technology Readiness Index (TRI) scores for each variable reveals that the level of readiness for the adoption of metaverse technology in virtual branch digital banking services in Bengkulu City has a TRI score of 2.37, which falls within the Low Technology Readiness category, indicating a low readiness for the adoption of this technology. The highest scores among the variables are found in the positive perspectives, with the Optimism variable scoring 0.69 and Innovativeness scoring 0.67. Additionally, the Discomfort variable has a score of 0.63, suggesting that the people of Bengkulu City feel optimistic, innovative, and comfortable regarding the potential adoption of metaverse technology. However, this is accompanied by a sense of insecurity, as indicated by the lowest score of the Insecurity variable at 0.38. This aligns with the findings of studies [10] and [11], which state that TRI values are measured based on the highest levels of each variable. The higher the scores for positive variables such as Optimism and Innovativeness, the greater the technological readiness; conversely, for negative variables such as Discomfort and Insecurity, the lower the scores indicate a lower technological readiness.

B. Inner Model

The purpose of testing the structural model is to identify and evaluate the relationships between exogenous variables (variables that influence) and endogenous variables (variables that are influenced). These relationships are expected to address the research objectives, including testing the hypotheses formulated in the study. The structural model testing in this research includes the Coefficient of Determination (R2) test, Predictive Relevance (Q2) test, Effect Size (f2) test, Path Coefficient (β) test, and T-Statistic test.

TABLE 6. Inner Model Result Test

| **Hypothesis** | | **$R^2$** | **$Q^2$** | **$f^2$** | **β** | **T-test** |
|---|---|---|---|---|---|---|
| **No** | **Path** | | | | | |
| 1 | H1*: Optimism* -> Metaverse Adoption | 0.386 | 0.292 | 0.014 | 0.142 | 1.161 |
| 2 | H2 *: Innovativeness* -> Metaverse Adoption | 0.386 | 0.292 | 0.106 | 0.411 | 3.363 |
| 3 | H3 : *Discomfort* -> Metaverse Adoption | 0.386 | 0.292 | 0.012 | -0.188 | 0.746 |
| 4 | H4 *: Insecurity* -> Metaverse Adoption | 0.386 | 0.292 | 0.049 | 0.373 | 1.646 |

**H1: Optimism influences customer readiness to adopt the metaverse.**

Based on the results, the path coefficient (β) test shows a positive value with a score of 0.142. This indicates that optimism has a positive effect on customer readiness for metaverse technology adoption. However, the t-statistic value is 1.161, suggesting that optimism has an insignificant impact on customer readiness for metaverse technology adoption. Therefore, it can be concluded that the relationship between the variables is positive but not significant, and H1 is rejected.

**H2: Innovativeness influences customer readiness to adopt the metaverse.**

Based on the results, the path coefficient (β) test shows a positive value with a score of 0.411. This indicates that innovativeness has a positive effect on customer readiness for metaverse technology adoption. Additionally, the t-statistic value is 3.363, indicating that innovativeness has a significant impact on customer readiness for metaverse technology adoption. Therefore, it can be concluded that the relationship between the variables is both positive and significant, and H2 is accepted.

**H3: Discomfort influences customer readiness to adopt the metaverse.**

Based on the results of the structural model test, the path coefficient (β) shows a negative value with a score of -0.188. This indicates that discomfort has a negative effect on customer readiness for metaverse technology adoption. Additionally, the t-statistic value is 0.746, suggesting that discomfort has an insignificant impact on customer readiness for metaverse technology adoption. Therefore, it can be concluded that the relationship between the variables is negative and not significant, and H3 is rejected.

**H4: Insecurity influences customer readiness to adopt the metaverse.**

Based on the results of the structural model test, the path coefficient (β) shows a positive value with a score of 0.373. This indicates that insecurity has a positive effect on customer readiness for metaverse technology adoption. Additionally, the t-statistic value is 1.646, suggesting that insecurity has an insignificant impact on customer readiness for metaverse technology adoption. Therefore, it can be concluded that the relationship between the variables is positive but not significant, and H4 is rejected.

## IV. CONCLUSION

The results of the TRI test indicate that the level of customer readiness in Bengkulu City for the potential adoption of metaverse technology in virtual branch digital banking services falls within the Low Technology Readiness category, signifying a low level of individual technological readiness, with a Technology Readiness Index (TRI) score of 2.37. Among the variables, the highest scores are found in the positive perspectives, with the Optimism variable scoring 0.69 and the Innovativeness variable scoring 0.67. Additionally, the Discomfort variable has a score of 0.63, indicating that the people of Bengkulu City feel optimistic, innovative, and comfortable with the potential adoption of metaverse technology. However, this is accompanied by a sense of insecurity, as reflected in the lowest score of the Insecurity variable, which is 0.38. Based on these findings, it can be concluded that the readiness for the potential adoption of metaverse technology in virtual branch digital banking services is relatively low, with customers exhibiting optimism, innovativeness, and comfort regarding the adoption of metaverse technology, yet accompanied by insecurity regarding its potential adoption.

Based on the data analysis results, the Technology Readiness Index (TRI) variable that significantly influences the potential adoption of metaverse technology in virtual branch digital banking services is the "Innovativeness" variable, with a path coefficient (β) of 0.411 and a t-statistic value of 3.363. Therefore, it can be concluded that the relationship between the variables is positive and significant. This finding indicates that an innovative attitude has a positive and significant impact on the potential adoption of metaverse technology in virtual branch digital banking services. Innovativeness, in this context, is defined as the tendency to be a pioneer in adopting such technology. The support for this hypothesis implies that an innovative attitude, as a positive perspective toward the technology, influences the level of readiness for the potential adoption of metaverse technology in virtual branch digital banking services.

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