BUSINESS PERSPECTIVES

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Hryhorii Skovoroda lane, 10,
Sumy, 40022, Ukraine

www.businessperspectives.org

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# THE MEDIATING EFFECT OF DIGITAL FINANCIAL INCLUSION ON GENDER DIFFERENCES IN DIGITAL FINANCIAL LITERACY AND FINANCIAL WELL-BEING: EVIDENCE FROM MALAYSIAN HOUSEHOLDS

## Abstract

This study aims to investigate the mediating effect of digital financial inclusion on the relationship between digital financial literacy and the financial well-being of Malaysian households, focusing on gender differences. Using quantitative research, a total of 210 responses, which contained 105 samples for each gender, were collected from households across Malaysia using a self-administered questionnaire. The research model was analyzed using Partial Least Square-Structural Equation Modelling techniques. The findings revealed significant relationships between digital financial literacy and digital financial inclusion, as well as between digital financial inclusion and financial well-being. Additionally, digital financial inclusion was found to significantly mediate the relationship between digital financial literacy and financial well-being, underscoring the importance of digital financial inclusion. The MICOM analysis results show that all constructs have good configural invariance, indicating the measures are consistent across groups. High correlations between males and females suggest similarities, but permutation tests indicate these similarities might be due to chance. Variance differences for digital financial literacy and digital financial inclusion are not significant. However, financial well-being shows a significant variance difference, suggesting less variability among males, supported by higher reliability scores for the financial well-being of males, indicating more consistent responses. Notably, the standardized beta for the digital financial inclusion – financial well-being path is higher among females, indicating a stronger influence of digital financial inclusion on financial well-being for this group. However, the direct relationship between digital financial literacy and financial well-being is insignificant for both genders.

**Keywords** financial, well-being, literacy, inclusion, women, digital, households, structural equation modelling techniques

**JEL Classification** D14, G53, I31, J16

**Received on:** 22nd of September, 2024
**Accepted on:** 5th of December, 2024
**Published on:** 12th of December, 2024

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**Conflict of interest statement:**
Author(s) reported no conflict of interest

## INTRODUCTION

Financial well-being is essential as it enables individuals to invest in critical areas like education and health, which are fundamental for personal growth and community progress, leading to improved long-term outcomes. It also enhances financial resilience by providing the means to handle unexpected financial events, reducing stress and uncertainty, and creating a sense of security. Moreover, financial well-being lowers stress levels associated with financial issues, thereby improving mental health and overall quality of life.

It is concerning to realize that nearly 40 percent of Malaysians are navigating life without a retirement plan in place. The Employees Provident Fund (EPF) shared some eye-opening statistics from last

year, revealing that only 4.0 percent of Malaysians can afford retirement (Kaur, 2024). Furthermore, approximately 2.4 million housewives in Malaysia are either unemployed or disengaged from the labor force, resulting in a lack of social protection. This situation renders them increasingly vulnerable to financial shocks. Focusing on the financial well-being of all individuals is crucial for ensuring their long-term prosperity and stability.

In today's evolving economic landscape, the Malaysian government acknowledges the importance of providing women equal opportunities in education and social and economic positions. However, gender inequality persists in Malaysian households, particularly in unpaid domestic work, influenced by traditional gender norms and ideologies (Boo, 2021).

Digital transformation can potentially improve the availability of financial services for underprivileged groups such as women, thus contributing to financial inclusion and enhancing their financial well-being. In developing nations, the gender gap in financial access has slightly narrowed in 2021, partly due to digital transformation in financial services (Demirgüç-Kunt et al., 2022). Digital technologies enable individuals and businesses to access financial services and products, significantly impacting emerging economies by filling gaps in traditional financial services for underserved and underprivileged populations.

In the digital era, digital financial literacy is paramount in determining digital financial inclusion because it directly influences individuals' ability to access, understand, trust, and effectively use digital financial services. Digital financial literacy facilitates broader and more meaningful participation in the digital financial ecosystem by addressing knowledge gaps, building confidence, and empowering users. However, the rapid development of digital products in the financial sector has not been accompanied by increased public literacy in digital finance.

## 1. LITERATURE REVIEW

Financial well-being refers to the state of being where an individual can fully meet current and ongoing financial obligations, feel secure in their financial future, and make choices that allow them to enjoy life (Consumer Financial Protection Bureau, 2015). Achieving financial well-being involves meeting current financial needs and responsibilities while ensuring the ability to sustain this lifestyle over time (Sang, 2021). Brüggen (2017) assessed financial well-being using objective, subjective, and hybrid measurements. Subjective indicators involve individuals' perceptions and satisfaction with their financial status, a critical component of this concept. Notably, subjective perception scales afford a deeper understanding of households' financial behaviors (Mokhtar & Husniyah, 2017; Nandru et al., 2021; Ngamaba et al., 2020; Sabri et al., 2021; Taft et al., 2013). In this study, financial well-being is evaluated by subjective financial well-being based on personal perception of the ability to achieve financial goals and enjoy life with financial freedom. Previous research has shown that the levels of financial inclusion influence financial well-being (Nandru et al., 2021; Rashid et al., 2022) and influence of financial literacy on financial well-being (Respati et al., 2023; Utkarsh et al., 2020). With the rise of the digital era, research may shift to examining the influence of digital financial inclusion and digital financial literacy on financial well-being.

Digital financial inclusion is defined as the accessibility of the underserved to use financial services through digital platforms and digital devices (Ozili, 2022). Thus, digital financial services can improve traditional financial inclusion for underserved populations (Widyastuti et al., 2024). The impact of digital financial inclusion has been seen in countries like Kenya and India. The COVID-19 pandemic has accelerated the adoption of digital financial inclusion, as people can now conduct financial transactions from home. The Global Findex Questionnaire 2021 (World Bank, 2021) measured financial inclusion and the Fintech revolution using mobile phones for payments, savings, and borrowing. In this study, digital financial in-


http://dx.doi.org/10.21511/imfi.22(1).2025.02

clusion is measured by accessibility and the use of financial services through digital devices for payments, borrowing, insurance, and investment.

Several studies have looked at this link and found that digital financial inclusion influences financial well-being. Hussain et al. (2019) found that households with formal financial accounts could enhance their financial well-being and stability in developing countries. Similarly, Mabrouk (2023) compelling evidence of the accelerated impact of digital financial inclusion on financial well-being in the context of the COVID-19 pandemic also facilitated greater participation of women in economic decision-making, thereby illustrating how digital financial inclusion can mitigate gender disparities.

Furthermore, digital financial inclusion is crucial in expanding individuals' capabilities by providing access to various financial services through digital channels, such as savings accounts, credit, insurance, and payment platforms. By facilitating convenient, affordable, and secure access to financial services, digital financial inclusion can participate more fully in economic activities, accumulate assets, manage risks, and cope with financial shocks, thereby contributing to their overall financial well-being (Kanungo & Gupta, 2021).

Digital financial inclusion broadens access to credit markets, enhancing financial well-being by increasing household consumption through changes in the marginal propensity to consume. However, the easier accessibility to credit markets also raises the risk of households falling into a debt trap, which can negatively impact their overall financial well-being in the long term (Yue et al., 2022).

Digital financial literacy, which encompasses the knowledge, skills, and confidence to use digital financial services effectively, enhances individuals' capabilities to manage their finances, make informed decisions, and access financial resources (Grohmann et al., 2018; Morgan & Long, 2020; Noor et al., 2020). Digital financial literacy is closely linked to digital financial inclusion, as individuals need the necessary knowledge and skills to participate fully and benefit from digital financial services (Prete, 2022; Sahay et al., 2021; Tony & Desai, 2020) (Sahay et al., 2021). Improving digital financial literacy can enhance digital financial inclusion by empowering individuals to access and utilize digital financial services effectively (Azeez & Akhtar, 2021; Choung et al., 2023). Enhancing digital financial literacy has been found to have a more pronounced impact on digital financial inclusion within the female group, suggesting that improving digital financial knowledge can be particularly beneficial for women's financial inclusion (Widyastuti et al., 2024).

Various elements, according to research, influence financial well-being. The CFPB highlights that increasing financial literacy programs aims to improve financial well-being (Harter & Harter, 2021; Utkarsh et al., 2020). Financial literacy refers to an individual's knowledge and awareness of financial ideas and products (Vieira et al., 2021; Vörös et al., 2021; Xiao & O'Neill, 2016, 2018). Research has shown that digital financial literacy significantly impacts financial well-being (Choung et al., 2023). Individuals with greater levels of digital financial literacy are more likely to make wise financial decisions, successfully manage their resources, and attain higher financial well-being (Choung et al., 2023; Low et al., 2023). Improving digital financial literacy is essential to making well-informed financial decisions, utilizing digital financial tools, and navigating Malaysia's evolving digital financial landscape (Khoo et al., 2022; Low et al., 2023). However, some studies found that it is insignificant between digital financial literacy and financial well-being (Muat et al., 2024; Respati et al., 2023). Still, digital financial literacy may influence financial behavior and indirectly enhance financial well-being (Gosal & Nainggolan, 2023).

Hasan et al. (2023) highlighted those with higher digital financial literacy are more likely to engage in formal banking channels. However, the specific mediating effect of digital financial inclusion in enhancing financial well-being has not been adequately addressed. At the same time, research by Widyastuti et al. (2024) aimed to explore the relationship between digital financial literacy and DFI while considering age, income, and gender differences. The direct relationship between digital financial literacy and financial well-being has been studied to some extent (Choung et al., 2023; Kumar et al., 2023). However, the mediating role of digital financial inclusion remains relatively unexplored, particularly concerning Malaysia.

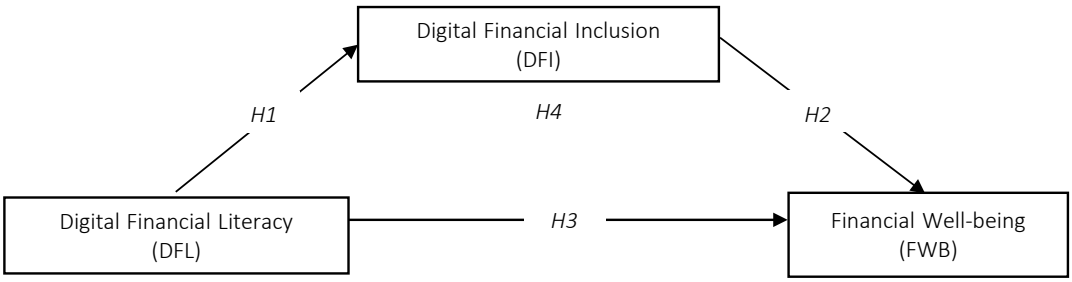



**Figure 1.** Research model

The mediation role of digital financial product usage and internet usage between financial literacy and financial inclusion further highlights the interconnectedness of these factors in promoting financial well-being (Shen et al., 2018). Salignac et al. (2020) identified a shortage of research on the impact of structural elements, such as socioeconomic differences and social interactions, on people's subjective well-being. The study also highlighted the importance of the interaction between households and social factors and how they affect financial well-being.

This study aims to explore financial well-being from a gender perspective, providing insights into psychological differences that impact financial well-being across genders. It examines women's empowerment as a key factor in enhancing financial well-being in Malaysia, with digital financial literacy as the primary predictor. Additionally, the study investigates the role of digital financial inclusion as a mediator, highlighting its influence in shaping overall financial well-being. The findings of this study are likely to help practitioners improve Malaysian households' financial well-being through digital financial literacy and digital financial inclusion.

Study hypotheses are as follows:

*H1: Digital financial literacy positively influences digital financial inclusion.*

*H2: Digital financial inclusion positively influences financial well-being.*

*H3: Digital financial literacy positively influences financial well-being.*

*H4: The effect of digital financial literacy on financial well-being is mediated by digital financial inclusion.*

In the research model shown in Figure 1, financial well-being is the dependent variable, while the independent variable is digital financial literacy. The mediating variable, digital financial inclusion, bridges the gap between digital financial literacy and financial well-being.

## 2. METHOD

A cross-sectional study was conducted using a self-administered questionnaire adapted from previous research and modified to fit this study context. The questionnaire distributed consisted of two sections. The first section contained demographic questions about the respondents, while the second section focused on financial well-being, digital financial inclusion, and digital financial literacy questions.

Responses were assessed using a 5-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree). The target group for this study is households in Malaysia. To determine the minimum sample size needed for this study, the G*Power software was used to calculate the effect size ($f^2$) and the required sample size (Faul et al., 2007). A linear multiple regression model will be established to explain the relationship between the variables outlined in the hypotheses. The significance level (α) is set at 0.05, the medium effect size ($f^2$) at 0.15, and the statistical power (1-ß) at 0.8, as suggested by Cohen (1988). Based on these parameters, a minimum sample size of 68 is needed for each gender group for a medium effect size with two predictors. Therefore, this study requires a minimum sample size of 68 for each male and female group.

Data were gathered through the distribution of physical and online questionnaires, including a Google Form link on social media throughout Malaysia. The


http://dx.doi.org/10.21511/imfi.22(1).2025.02

survey took place from December 2023 to March 2024, with 210 responses collected and 105 samples for each gender group.

This study analyzes the data using partial least squares structural equation modeling (PLS-SEM). The assessment of the measurement model determines the validity and reliability of the instruments, while the structural model assesses the study hypotheses (Henseler et al., 2016). The multi-group analysis (MGA) examines the differences between males and females. It is a robust method for assessing moderation across multiple relationships in a research model (Cheah et al., 2023).

Conducting a Multi-Group Analysis (MGA) with data grouped by gender and based on a reflective measurement model involves a series of structured steps that ensure the analysis is rigorous and meaningful. Data preparation is the first step in this process, which generates data groups. Since the groups are already defined by gender, the primary task is to ensure that the dataset accurately categorizes participants into male and female groups. Adequate sample sizes are essential for maintaining statistical power and reducing bias, allowing the analysis to detect meaningful differences or similarities between groups (Cheah et al., 2020).

Next is testing for measurement invariance using the Measurement Invariance of Composites (MICOM) procedure. The MICOM procedure involves testing for configural, composition, and measurement invariance. Configural invariance ensures that the model's basic structure is consistent across groups. Composition invariance checks that factor loadings are equivalent, while measurement invariance examines the equality of item intercepts. Achieving measurement invariance is vital, as it confirms that any observed differences between groups are due to actual relationship differences rather than measurement inconsistencies (Cheah et al., 2020).

Once measurement invariance is established, the fourth step is to determine the goal of the analysis. It is essential to clearly define what the analysis aims to uncover, such as differences in relationships between constructs or effects of variables across gender groups. The final step is analyzing and interpreting the MGA test results. This involves comparing structural paths and relationships across gender groups to identify significant differences or similarities.

The demographic information of the respondents is presented in Table 1. The data set includes an equal distribution of females and males, each comprising 50% of the total respondents. The largest age group is between 35 and 44 years, making up 32% of the respondents. This is followed by the 25 to 34 age group at 29%, and the 45 to 54 age group at 21%. The 55 to 60 age group accounts for 6%, while the 18 to 24 age group represents 9%. Only 3% of respondents are over 61 years old.

In terms of education level, 36% of respondents have completed secondary education, and 41% hold a diploma. A smaller percentage, 16%, have obtained a bachelor's degree, while only 3% have either postgraduate degrees or have completed primary education.

Regarding household income, 24% of respondents earn less than RM1,500. Those earning between RM1,501 and RM3,500 account for 36%. A smaller group, at 5%, earns between RM3,501 and RM5,500. The income brackets of RM5,501 to RM7,500 consist of 18% of respondents, while those earning between RM7,501 and RM9,500 make up 15%. Only 2% of the respondents have household incomes exceeding RM9,500.

**Table 1.** Demographic analysis

| Demographic | Responses | Frequency | Percentage |
|---|---|---|---|
| Gender | Female | 105 | 50% |
| | Male | 105 | 50% |
| Age | 18-24 | 18 | 9% |
| | 25-34 | 60 | 29% |
| | 35-44 | 68 | 32% |
| | 45-54 | 44 | 21% |
| | 55-60 | 13 | 6% |
| | >61 | 7 | 3% |
| Education Level | Primary | 7 | 3% |
| | Secondary | 76 | 36% |
| | Diploma | 86 | 41% |
| | Bachelor | 34 | 16% |
| | Postgraduate | 7 | 3% |
| Household Monthly Income Level | <RM1500 | 50 | 24% |
| | RM1501-RM3500 | 76 | 36% |
| | RM3501-RM5500 | 11 | 5% |
| | RM5501-RM7500 | 37 | 18% |
| | RM7501-RM9500 | 31 | 15% |
| | >RM9500 | 5 | 2% |

# 3. RESULTS

The measurement model table (Appendix B1) provides factor loadings, Cronbach's alpha, composite reliability, and average variance extracted (AVE) for three constructs across the complete dataset, female and male. Notably, the indicator DFI2 was removed from the model due to outer loadings falling below the 0.5 threshold value (Henseler et al., 2016), ensuring the remaining indicators reflect their respective constructs more accurately.

Most indicators' Cronbach alpha and composite reliability loadings exceed 0.7, indicating strong reliability and validity (Henseler et al., 2016). Reliability metrics further affirm its robustness, with Cronbach alpha and composite reliability values demonstrating high reliability across all groups, indicating consistent scales. AVE values are generally above the threshold value of 0.5, indicating adequate convergent validity (Henseler et al., 2016), except for financial well-being in females, which is marginal. Males have slightly lower AVE for digital financial inclusion and digital financial literacy but higher AVE for financial well-being than females.

Table 2 shows the Heterotrait-Monotrait ratio (HTMT) matrix assesses the discriminant validity among three constructs, digital financial inclusion, digital financial literacy, and financial well-being, across three groups: complete, female, and male. The complete refers to a complete data set that includes male and female data; the study further segregated the complete data into two, which are male and female. Discriminant validity indicates whether constructs that are supposed to be different are distinct. HTMT values below 1 are typically acceptable, suggesting good discriminant validity (Henseler et al., 2016). The HTMT analysis reveals that while digital financial inclusion and digital financial literacy may not be distinct for males (0.86), the discriminant validity between other construct pairs (digital financial inclusion and financial well-being, digital financial literacy, and financial well-being) is generally acceptable across all groups.

**Table 2.** Heterotrait-Monotrait ratio (HTMT) – matrix

| Construct | DFI | | | DFL | | | FWB | | |
|---|---|---|---|---|---|---|---|---|---|
| | Complete | Female | Male | Complete | Female | Male | Complete | Female | Male |
| DFI | | | | | | | | | |
| DFL | 0.810 | 0.792 | 0.860 | | | | | | |
| FWB | 0.608 | 0.625 | 0.591 | 0.495 | 0.500 | 0.514 | | | |

*Note*: DFL: Digital Financial Literacy; DFI: Digital Financial Inclusion; FWB: Financial Well-being.

**Table 3.** Hypotheses testing results

| Data Set | Relationship | Std. Beta | Std. Error | T values | P values | PCI LL | PCI UL | $f^2$ | VIF | Result |
|---|---|---|---|---|---|---|---|---|---|---|
| Complete | H1: DFL → DFI | 0.740 | 0.027 | 26.954* | 0.000 | 0.688 | 0.781 | 1.213 | 1.000 | Accepted |
| | H2: DFI → FWB | 0.473 | 0.072 | 6.564* | 0.000 | 0.344 | 0.581 | 0.140 | 2.213 | Accepted |
| | H3: DFL → FWB | 0.073 | 0.074 | 0.992 | 0.161 | -0.049 | 0.197 | 0.003 | 2.213 | Rejected |
| | H4: DFL → DFI → FWB | 0.344 | 0.063 | 5.448* | 0.000 | 0.256 | 0.434 | 0.118 | | Accepted |
| Female | H1: DFL → DFI | 0.720 | 0.035 | 20.429* | 0.000 | 0.647 | 0.767 | 1.073 | 1.000 | Accepted |
| | H2: DFI → FWB | 0.478 | 0.086 | 5.580* | 0.000 | 0.320 | 0.603 | 0.154 | 2.073 | Accepted |
| | H3: DFL → FWB | 0.072 | 0.086 | 0.860 | 0.202 | -0.070 | 0.215 | 0.003 | 2.073 | Rejected |
| | H4: DFL → DFI → FWB | 0.344 | 0.062 | 5.574* | 0.000 | 0.235 | 0.440 | 0.118 | | Accepted |
| Male | H1: DFL → DFI | 0.799 | 0.033 | 24.034* | 0.000 | 0.729 | 0.843 | 1.766 | 1.000 | Accepted |
| | H2: DFI → FWB | 0.458 | 0.167 | 2.749* | 0.006 | 0.153 | 0.707 | 0.107 | 2.766 | Accepted |
| | H3: DFL → FWB | 0.098 | 0.171 | 0.283 | 0.216 | -0.184 | 0.387 | 0.005 | 2.766 | Rejected |
| | H4: DFL → DFI → FWB | 0.366 | 0.137 | 2.667* | 0.004 | 0.118 | 0.575 | 0.134 | | Accepted |

*Note*: * represents $p < 0.05$, 5,000 bootstrapping procedure; DFL: Digital Financial Literacy; DFI: Digital Financial Inclusion; FWB: Financial Well-being.


http://dx.doi.org/10.21511/imfi.22(1).2025.02

The hypotheses testing result indicates various relationships between the constructs of digital financial inclusion (DFI), digital financial literacy (DFL), and financial well-being (FWB) for both females and males. The result shown in Table 3 presents a statistical analysis of four hypotheses involving three variables: digital financial literacy, digital financial inclusion, and financial well-being. The analysis includes several metrics: Standard Beta, Standard Error, t-values, p-values, Percentile Confidence Intervals (PCI), $f^2$, and VIF (Variance Inflation Factor). These metrics are calculated for Complete, Female, and Male.

*H1: Digital financial literacy positively influences digital financial inclusion.*

The first hypothesis suggests a statistically significant and positive direct relationship between digital financial literacy and digital financial inclusion across all groups ($\beta_{Complete}$: 0.740, p<0.000; $\beta_{Female}$: 0.720, p<0.000; $\beta_{Male}$: 0.799, p<0.000), indicating a strong positive relationship. The PCI ranges are narrow and positive, reinforcing digital financial literacy strong, positive impact on digital financial inclusion. The $f^2$ values indicate a large effect size ($f^2_{Complete}$: 1.213; $f^2_{Female}$:1.073; $f^2_{Male}$:1.766), especially for the Male group, and the VIF value of 1.000 suggests that there are no issues with multicollinearity.

*H2: Digital financial inclusion positively influences financial well-being.*

For the second hypothesis, the relationship between digital financial inclusion and financial well-being shows a statistically significant and positive effect ($\beta_{Complete}$: 0.473, p<0.000; $\beta_{Female}$: 0.478, p<0.000; $\beta_{Male}$: 0.458, p<0.05). The female group has a slightly stronger relationship than the male group. The PCI ranges are narrow and positive, reinforcing digital financial inclusion's strong, positive impact on financial well-being. The $f^2$ values show a moderate effect ($f^2_{Complete}$: 0.140; $f^2_{Female}$:0.154; $f^2_{Male}$:0.107), particularly in the Male group, and the VIF values are all within acceptable limits.

*H3: Digital financial literacy positively influences financial well-being.*

Hypothesis 3 examines the direct impact of digital financial literacy on financial well-being. The results show no association between digital financial literacy and financial well-being ($\beta_{Complete}$: 0.073, p=0.161; $\beta_{Female}$: 0.072, p=0.202; $\beta_{Male}$: 0.098, p=0.216) for all the sample sets. The PCI includes zero for all groups, suggesting no meaningful effect. The $f^2$ values ($f^2_{Complete}$: 0.003; $f^2_{Female}$:0.003; $f^2_{Male}$:0.005) are very low, indicating a negligible effect size, and the VIF values are within acceptable limits, indicating no multicollinearity.

*H4: The effect of digital financial literacy on financial well-being is mediated by digital financial inclusion.*

Hypothesis 4 tests the mediated relationship where digital financial literacy influences financial well-being through digital financial inclusion. The results show statistically significant and positive mediation effects of digital financial inclusion on the relationship between digital financial literacy and financial well-being ($\beta_{Complete}$: 0.344, p<0.000; $\beta_{Female}$: 0.344, p<0.000; $\beta_{Male}$: 0.366, p<0.004). The confidence intervals do not include zero, indicating a reliable mediated effect. The $f^2$ values ($f^2_{Complete}$: 0.118; $f^2_{Female}$: 0.118; $f^2_{Male}$: 0.134) suggest a medium effect size (Kenny, 2021), and the VIF values indicate no multicollinearity issues.

To support the results, the predictive power of the models was evaluated using $R^2$ and $Q^2$, as presented in Table 4.

The $R^2$ for DFI (complete: 0.686; female: 0.646; male: 0.797) shows a high level of explained variance, particularly in the male group for DFI, while financial well-being shows lower $R^2$ values (complete: 0.388;

**Table 4.** Results of $R^2$ and $Q^2$

| Construct | $R^2$ | | | $Q^2$_Predict | | |
|---|---|---|---|---|---|---|
| | Complete | Female | Male | Complete | Female | Male |
| DFI | 0.686 | 0.646 | 0.797 | 0.541 | 0.506 | 0.621 |
| FWB | 0.388 | 0.401 | 0.376 | 0.170 | 0.157 | 0.187 |

*Note*: DFI: Digital Financial Inclusion; FWB: Financial Well-being.

**Table 5.** MICOM results

| Construct | Configural Invariance | Compositional Invariance | | | Composition Invariance | Equal Mean Value | | | Equal Variances | | | Measurement Invariance |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | c=1 | Confidence Interval | p–value | | Diff | Confidence Interval | p–value | Diff | Confidence Interval | p–value | |
| DFL | Yes | 0.999 | 0.995 | 0.679 | Yes | 0.173 | [–0.190;0.172] | 0.050 | –0.041 | [–0.279;0.295] | 0.400 | Full |
| DFI | Yes | 0.999 | 0.996 | 0.376 | Yes | 0.254 | [–0.194;0.189] | 0.008 | –0.061 | [–0.227;0.261] | 0.309 | Full |
| FWB | Yes | 0.996 | 0.972 | 0.639 | Yes | –0.015 | [–0.191;0.187] | 0.457 | –0.404 | [–0.291;0.333] | 0.015 | Partial |

*Note*: DFL: Digital Financial Literacy; DFI: Digital Financial Inclusion; FWB: Financial Well-being.

female: 0.401; male: 0.376), indicating less variance explained by the predictors. The $Q^2$ prediction values suggest the model has predictive relevance, particularly for digital financial inclusion.

The multigroup analysis is conducted to understand further variations between males and females. The sample data was divided into two groups (Male = 105, Female = 105). Table 5 presents the MICOM established based on the recommendation by Henseler et al. (2016).

Table 5 presents the results of MICOM analysis, demonstrating that all constructs exhibit good configural invariance. The strong original correlations indicate a high similarity between females and males. However, the permutation p-values (> 0.05) suggest that these high correlations are not statistically significant, indicating that the observed similarities could be due to chance.

The differences in variance for digital financial literacy (-0.041) and digital financial inclusion (–0.061) are not significant (p-values > 0.05), while the variance difference for financial well-being (–0.404) is significant (p-value = 0.015), suggesting lower variability in financial well-being among males compared to females. This is consistent with the higher reliability metrics (CA and CR) for financial well-being in males (Appendix B1), indicating more consistency in males.

Table 6 presents the multi-group analysis of the data comparing males and females, revealing several insights into the relationships among the variables: digital financial literacy, digital financial inclusion, and financial well-being. For the path DFL → DFI, both genders exhibit very strong and significant relationships, with males showing a slightly stronger effect ($\beta_{Female}$: 0.720, p<0.000; $\beta_{Male}$: 0.799, p<0.000) and both having highly significant p-values. However, this contradicts a study by Widyastuti et al. (2024), which shows that the influences of digital financial literacy on digital financial inclusion are stronger in the female path.

In the path DFI → FWB, the relationship is significant for both genders, with females showing a marginally stronger effect (standard beta of 0.478 vs. 0.458) and a more robust t-value (5.580 for females compared to 2.749 for males). This indicates that digital financial inclusion influences financial well-being more strongly for females.

However, the direct path from digital financial literacy to financial well-being does not show significance for either group, as reflected by low t-values (0.833 for females and 0.574 for males) and high p-values (P>0.05), suggesting that digital financial literacy does not directly affect financial well-being for either gender.

**Table 6.** Multigroup analysis results

| Relationship | Std. Beta | | t-value | | p-value | |
|---|---|---|---|---|---|---|
| | Female | Male | Female | Male | Female | Male |
| H1: DFL → DFI | 0.720 | 0.799 | 20.429 | 24.034 | 0.000 | 0.000 |
| H2: DFI → FWB | 0.478 | 0.458 | 5.580 | 2.749 | 0.000 | 0.003 |
| H3: DFL → FWB | 0.072 | 0.098 | 0.833 | 0.574 | 0.202 | 0.283 |
| H4: DFL → DFI → FWB | 0.344 | 0.366 | 5.448 | 2.667 | 0.000 | 0.004 |

*Note*: DFL: Digital Financial Literacy; DFI: Digital Financial Inclusion; FWB: Financial Well-being.


http://dx.doi.org/10.21511/imfi.22(1).2025.02

The indirect effect, DFL → DFI → FWB, is significant for both males and females, with females showing slightly stronger significance (t-value of 5.448 vs. 2.667 and p-value of 0.000 vs. 0.004). This highlights digital financial inclusion as a crucial mediator in influencing financial well-being, especially for females.

## 4. DISCUSSION

The result of this study suggests that digital financial literacy strongly influences digital financial inclusion across all groups, with a statistically significant and positive effect. Individuals with digital financial literacy possess the knowledge, awareness, and practical skills that enable them to participate in and utilize digital financial services. This finding aligns with previous research by Hasan et al. (2023) and Morgan and Long (2020), indicating that a higher degree of digital financial literacy is more likely to engage in formal banking services.

The relationship between digital financial inclusion and financial well-being is positively significant, especially in the female group, though the effect is moderate. Digital financial inclusion increases individuals' access to financial services such as payments, savings, borrowing, insurance, and investment, helping them to better manage their finances and thus enhance their financial well-being. The findings are consistent with previous research, which suggests that individuals with digital financial inclusion can improve their financial well-being due to enhanced access to and utilization of formal financial services (Kanungo & Gupta, 2021; Nandru et al., 2021; Rashid et al., 2022; Selvia et al., 2021).

However, the findings show no association between digital financial literacy and financial well-being. The results contradict the studies by Choung et al. (2023) and Gosal and Nainggolan (2023); their research encountered a positive relationship between digital financial literacy and financial well-being. However, other studies with similar findings show no significant relationship between digital financial literacy and financial well-being (Muat et al., 2024; Respati et al., 2023). Similarly, a meta-analysis showed that the relationship between financial literacy and financial well-being might be inconsistent (Santini et al., 2019). They suggest that financial literacy may have a weaker impact than previously thought, with factors such as financial behavior and socioeconomic status playing a more significant role.

Next, the findings show the mediating effect of digital financial literacy on financial well-being through digital financial inclusion. This suggests that digital financial inclusion plays a crucial role as a mediator in this relationship. Rahayu et al. (2022) asserted that digital financial literacy is a recently developed concept that gauges an individual's understanding of finances through the use of digital technology. This literacy enables individuals to make informed and appropriate financial decisions, ultimately enhancing financial well-being (Kumar et al., 2023). Therefore, the analysis highlights the importance of considering the mediation effect of digital financial inclusion when exploring the impact of digital financial literacy on financial well-being and points out the complexity of relationships in multivariate analyses.

The findings of MICOM results indicate that although there are high correlations between females and males, these correlations are not statistically significant. Mean differences between the groups are also insignificant, indicating no substantial difference in average values. The significant variance difference in financial well-being (lower in males) suggests more consistent financial well-being among males than females. Furthermore, digital financial literacy and digital financial inclusion show full measurement invariance (strong consistency), while financial well-being has partial measurement invariance (some differences in variance).

Research supports the notion that measurement invariance allows researchers to confidently compare constructs like financial well-being across different groups. Studies show that meaningful interpretations remain valid while there can be differences in variance. For instance, the validation and measurement invariance of the Personal Financial Wellness scale across multiple countries demonstrated that despite some variations, the scale reliably measures subjective financial stress and provides valid comparisons across groups, particularly when metric invariance is achieved

(Buabang et al., 2022). This supports the idea that even with some variance, the constructs can still yield meaningful insights when analyzed properly.

The analysis shows that while digital financial literacy's direct effect on financial well-being is insignificant, digital financial inclusion plays a critical role in mediating this relationship for both genders, with females experiencing slightly stronger effects. This underscores the importance of considering indirect paths in understanding these relationships in structural models.

## CONCLUSION

This study investigates the impact of digital financial literacy and inclusion on Malaysian households' financial well-being, emphasizing the notable gender differences present in this context. By analyzing these relationships, the study seeks to reveal both direct and indirect effects of digital financial literacy on financial well-being across genders. For both males and females, digital financial literacy strongly impacts digital financial inclusion, with males experiencing a slightly stronger effect. However, digital financial inclusion has a more substantial impact on females' financial well-being than males, underscoring its critical role in enhancing the financial well-being of women. The direct relationship between digital financial literacy and financial well-being is insignificant for either gender, indicating that digital financial literacy alone does not directly impact financial well-being without the mediating effect of digital financial inclusion.

The statistically significant findings of this study have important implications for policy and practice in improving the financial well-being of households in Malaysia. Given the significant role of digital financial inclusion as a mediator, policies and programs should prioritize improving women's access to financial services and resources. Financial education initiatives should enhance women's digital financial literacy to facilitate greater digital financial inclusion. For practitioners, these insights can inform the development of targeted interventions that address the unique financial challenges faced by women. By understanding these gender-specific dynamics, policymakers can create more effective strategies to support women's financial empowerment, ultimately leading to improved financial well-being and greater economic equity in Malaysia.

Further studies should explore the underlying reasons for these gender differences, potentially considering socio-economic, cultural, and psychological factors that might influence digital financial inclusion and well-being. Interventions aiming to enhance financial well-being should consider gender-specific strategies, given the different pathways observed in the data. Additional studies should validate these findings across different populations to ensure generalizability and understand the broader implications of digital financial literacy and inclusion on financial well-being.

## AUTHOR CONTRIBUTIONS

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http://dx.doi.org/10.21511/imfi.22(1).2025.02

## ACKNOWLEDGMENT

This research was supported by the Ministry of Higher Education (MoHE) of Malaysia through the Fundamental Research Grant Scheme (FRGS/1/2022/SS01/UUM/02/10).

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# APPENDIX A

**Table A1.** Questionnaire

| Variables | Items | Sources |
|---|---|---|
| Digital Financial Literacy (DFL) | I never share my password and PIN of my bank account with close friends.<br>I am aware of the security of a website (https sites, safety logo, or certificates) before making online transactions.<br>I use a smartphone to send or receive calls, send or receive text messages, and send or receive photos.<br>I use a phone to browse or use the Internet, download music, videos, or games, make financial transactions, or access social networking sites.<br>I know how to open an online banking/mobile banking/e-wallet menu, find the particular menu options, initiate a transaction, and complete a transaction successfully.<br>I know how to correct an error or reverse or cancel a transaction successfully when doing transactions on online banking/mobile banking/e-wallet.<br>I have experience in transferring/receiving money by using mobile banking/online banking/e-wallet.<br>I have the experience of checking my account balance using mobile banking/online banking/e-wallet.<br>I know the benefits of using mobile banking/online banking/e-wallet. | Choung et al. (2023) |
| Digital Financial Inclusion (DFI) | I access banking services using Internet banking/mobile banking/e-wallet.<br>I can borrow money from the Internet/ mobile banking/e-wallet.<br>I can make a payment by using Internet/mobile banking/e-wallet.<br>I can buy an insurance plan through the internet/mobile banking/e-wallet.<br>I can make investments with Internet/mobile banking/e-wallet.<br>I use Internet/mobile banking/e-wallet at least once a month.<br>Online banking/mobile banking/e-wallet is user-friendly. | World Bank (2021) |
| Financial Well-being (FWB) | I can create wealth by accessing financial services.<br>I can meet my family's financial commitments.<br>My living standards have improved with the financial services.<br>My income always covers my living costs.<br>I do not need to borrow to buy essential goods. | Nandru et al. (2021) |

# APPENDIX B

**Table B1.** Measurement model

| Constructs | Item | Factor Loading | | | CA | | | CR | | | AVE | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Complete | Female | Male | Complete | Female | Male | Complete | Female | Male | Complete | Female | Male |
| Digital Financial Inclusion (DFI) | DFI1 | 0.798 | 0.810 | 0.768 | 0.854 | 0.859 | 0.849 | 0.890 | 0.894 | 0.887 | 0.577 | 0.586 | 0.569 |
| | DFI3 | 0.876 | 0.874 | 0.888 | | | | | | | | | |
| | DFI4 | 0.656 | 0.689 | 0.590 | | | | | | | | | |
| | DFI5 | 0.698 | 0.684 | 0.778 | | | | | | | | | |
| | DFI6 | 0.746 | 0.749 | 0.735 | | | | | | | | | |
| | DFI7 | 0.764 | 0.771 | 0.738 | | | | | | | | | |
| Digital Financial Literacy (DFL) | DFL1 | 0.571 | 0.535 | 0.643 | 0.901 | 0.899 | 0.903 | 0.920 | 0.919 | 0.921 | 0.567 | 0.565 | 0.566 |
| | DFL2 | 0.650 | 0.599 | 0.742 | | | | | | | | | |
| | DFL3 | 0.686 | 0.688 | 0.685 | | | | | | | | | |
| | DFL4 | 0.741 | 0.764 | 0.687 | | | | | | | | | |
| | DFL5 | 0.840 | 0.878 | 0.747 | | | | | | | | | |
| | DFL6 | 0.673 | 0.662 | 0.710 | | | | | | | | | |
| | DFL7 | 0.866 | 0.864 | 0.863 | | | | | | | | | |
| | DFL8 | 0.847 | 0.843 | 0.840 | | | | | | | | | |
| | DFL9 | 0.841 | 0.850 | 0.825 | | | | | | | | | |
| Financial Well-being (FWB) | FWB1 | 0.664 | 0.655 | 0.694 | 0.789 | 0.752 | 0.851 | 0.855 | 0.833 | 0.893 | 0.545 | 0.507 | 0.627 |
| | FWB2 | 0.824 | 0.822 | 0.832 | | | | | | | | | |
| | FWB3 | 0.855 | 0.862 | 0.850 | | | | | | | | | |
| | FWB4 | 0.713 | 0.657 | 0.800 | | | | | | | | | |
| | FWB5 | 0.604 | 0.508 | 0.776 | | | | | | | | | |

*Note*: DFL: Digital Financial Literacy; DFI: Digital Financial Inclusion; FWB: Financial Well-being.


http://dx.doi.org/10.21511/imfi.22(1).2025.02