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Determinants of financial and digital financial literacy among micro and small-scale enterprise owners in Yogyakarta, Indonesia⁷

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Abstract: This study examines the levels and determinants of financial literacy (FL) and digital financial literacy (DFL) among micro-scale enterprise owners in Yogyakarta. Using survey data from micro enterprises across multiple sectors, the analysis assesses literacy across knowledge, attitudes, and behavioural dimensions. The findings reveal that both FL and DFL remain relatively low, particularly in knowledge and behaviour, despite generally positive attitudes. Demographic such as gender, age, and education, significantly influence FL and DFL, with male, younger, and more educated owners exhibiting higher literacy. Socioeconomic factors also shape outcomes: permanent income employment decreases DFL, family income support enhances digital financial attitudes, while a larger number of dependents and reliance on community-based financial support reduce digital financial engagement. Business characteristics such as turnover and type, along with technology-related factors

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including internet access and digital payment tools, further affect literacy levels; however, access alone does not guarantee responsible digital financial behaviour. Mediation analysis confirms that FL plays a critical role in strengthening DFL, underscoring the importance of foundational financial knowledge and behaviour in digital financial adoption. The study offers insights for policies aimed at improving digital financial inclusion among micro enterprises in emerging economies.

Keywords: financial literacy; digital financial literacy; msme; demographic; socio-economic

Determinante finansijske i digitalne finansijske pismenosti među vlasnicima mikro i malih preduzeća u Yogyakarta, Indonezija

Apstrakt: Ova studija ispituje nivoe i determinante finansijske pismenosti (FL) i digitalne finansijske pismenosti (DFL) među vlasnicima mikro-MSP u Yogyakarta. Koristeći anketne podatke mikropreduzeća iz više sektora, analiza procenjuje pismenost u dimenzijama znanja, stavova i ponašanja. Nalazi pokazuju da su i FL i DFL relativno niski, posebno u dimenzijama znanja i ponašanja, uprkos generalno pozitivnim stavovima. Demografske karakteristike, pol, starost i obrazovanje, značajno utiču na FL i DFL, pri čemu muškarci, mlađi i obrazovaniji vlasnici pokazuju viši nivo pismenosti. Socioekonomski faktori takođe oblikuju rezultate: stalno zaposlenje smanjuje DFL, porodična finansijska podrška poboljšava digitalne finansijske stavove, dok veći broj izdržavanih članova i oslanjanje na zajedničku finansijsku pomoć smanjuju digitalno finansijsko angažovanje. Karakteristike poslovanja kao što su promet i tip delatnosti, zajedno sa faktorima povezanim s tehnologijom, uključujući pristup internetu i digitalnim alatima za plaćanje, dodatno utiču na nivo pismenosti; međutim, sam pristup ne garantuje odgovorno digitalno finansijsko ponašanje. Analiza medijacije potvrđuje da FL ima ključnu ulogu u jačanju DFL, naglašavajući važnost osnovnog finansijskog znanja i ponašanja u usvajanju digitalnih finansijskih usluga. Studija nudi uvide za politike usmerene na unapređenje digitalne finansijske inkluzije među mikropreduzećima u ekonomijama u razvoju.

Ključne reči: finansijska pismenost; digitalna finansijska pismenost; MSP; demografija; socioekonomija.

1. Introduction

Financial literacy has increasingly become a critical component of economic empowerment and financial inclusion. In Indonesia, notable progress has been

achieved in recent years. According to the 2024 National Survey on Financial Literacy and Inclusion (OJK & BPS Indonesia, 2024). The national financial literacy rate reached 65.43%, rising slightly to 66.46% in 2025 (OJK, 2025). Despite this improvement, Indonesia still lags behind several ASEAN countries such as Thailand and Malaysia. The (OECD, 2020a) survey reported that Indonesia's financial literacy score was 13.3 out of 21, compared to the OECD average of 13.7. Similarly, Thailand recorded a financial literacy score of approximately 71.4% in 2022, above the OECD average of 60–63% (UNCDF, 2024), while Malaysia reported 61% in the 2023 ASEAN Monitoring Progress Report (AFCWP). When benchmarked against developed economies, Indonesia's score remains below the OECD average, the OECD (2023b) International Survey of Adult Financial Literacy found that Indonesia scored 63.5 (normalized to 100), while OECD average stood at 63, Malaysia 59.7, Hong Kong 71.1 and South Korea 62.1.

Financial literacy contributes significantly to economic growth by enabling individuals and business owners to make informed financial decisions, manage budgets and avoid unsustainable debt (Katnic et al., 2024). A financially literate society promotes saving, investment and efficient resource allocation, all of which support macroeconomic stability and long-term welfare. In Indonesia, Micro, Small and Medium Enterprises (MSMEs) play a pivotal role in this process. MSMEs account for 61% of the national Gross Domestic Product (equivalent to IDR 9.580 trillion) and employ 117 million workers, about 97% of the total workforce. Given their economic significance, strengthening financial literacy among MSMEs is essential for fostering financial resilience, business sustainability and inclusive growth.

Financial literacy (FL) is commonly defined as the combination of knowledge, skills and confidence that shape individuals' financial attitudes and behaviours (OECD, 2023b). In the MSMEs context, FL supports key business functions such as cash-flow management, credit utilization, investment and business growth (Potrich et al., 2018). Higher levels of FL enable MSME owners to make sound financial decisions, mitigate financial risks and improve business competitiveness in an increasingly dynamic market environment.

In parallel, the rapid expansion of financial technology has broadened the scope of financial literacy to include digital financial literacy (DFL). DFL refers to the ability to access, understand and securely use digital financial services, such as mobile banking, e-wallets, peer-to-peer lending and e-commerce payment systems (OECD, 2020b, 2024a). Unlike conventional FL, which emphasizes budgeting, saving, borrowing and investing, DFL highlights digital competencies such as digital transactions, cybersecurity awareness and comparative evaluation of digital financial products (OECD, 2024a). As financial systems worldwide continue to digitalize, DFL has become a vital subdimension

of financial literacy, especially for MSMEs operating within digital business ecosystems (Chhillar et al., 2025).

At the provincial level, regional disparities in financial literacy remain evident. In 2022, West Nusa Tenggara (65.45%), Bangka Belitung (62.35%) and Bali (57.66%) recorded the highest financial literacy rates (OJK, 2022). While the Special Region of Yogyakarta (DIY), a province widely recognized as Indonesia's "student city" with one of the nation's highest average years of schooling (9.75 years, fifth nationally) (BPS DIY, 2024), ranks only tenth with a financial literacy rate of 54.55% (OJK, 2022). This paradox between high educational attainment and relatively low financial literacy highlights an important gap that merits deeper investigation.

Previous studies identify multiple determinants of financial literacy, including demographic characteristics such as age, gender, and education (Ahunov & Van Hove, 2020; Nguyen, 2024; Potrich et al., 2018; Rehman & Mia, 2024; Riebe, 2020; Sangeeta & Aggarwal, 2022), as well as socioeconomic factors like income and number of dependents (Ahunov & Van Hove, 2020; Bhushan & Medury, 2013; Nguyen, 2024; Rehman & Mia, 2024; Riebe, 2020; Sangeeta & Aggarwal, 2022). However, findings remain inconsistent across contexts, some studies find that gender and marital status are insignificant (Bhushan & Medury, 2013; Neha & Rao, 2021), while others identify strong effects (Chhillar et al., 2025; Potrich et al., 2018; Ravikumar et al., 2022). Some studies also report that socioeconomic variables, such as income, do not exert a significant effect (Neha & Rao, 2021). Moreover, the role of technological proficiency and social engagement, two increasingly important dimensions in the digital economy, has been underexplored.

Previous research has also largely focused on individuals or households in developed countries and urban settings, with limited evidence from MSMEs in emerging economics (Klapper et al., 2015; OECD, 2023b). In Indonesia, most studies rely on self-reported perceptions rather than comprehension-based assessments, raising concerns about validity and reliability (M. Dewi et al., 2025; V. I. Dewi et al., 2020; Lantara & Kartini, 2015; Rizkan et al., 2022; Sulistyowati & Suryanto, 2025; Thomas et al., 2024; Viana et al., 2021). Furthermore, studies rarely integrate digital financial literacy as a distinct construct in MSME analysis, despite the sector's increasing reliance on digital platforms for transactions and financing.

This study addresses these gaps by examining the levels and determinants of financial literacy, both conventional and digital, among MSMEs owners in Special regional of Yogyakarta. Specifically, the objectives are (1) to measure the financial and digital financial literacy levels of MSME owners in Yogyakarta and (2) to identify demographic, socioeconomic, business and technological factors that influence financial and digital financial literacy.

This research offers three key contributions. First, it extends the existing literature on financial literacy by incorporating technology adoption and social dimensions as explanatory variables. Second, it integrates digital financial literacy as an essential extension of conventional financial literacy within the context of the digital economy. Third, this study employs comprehension-based scoring to objectively measure literacy levels, offering more reliable evidence compared to perception-based methods widely used in prior studies.

2. Literature Review

2.1. Financial Literacy (FL) and Digital Financial Literacy (DFL)

FL refers to knowledge, skills, attitudes and behaviours that enable individuals to make financial decisions (OECD, 2020c) and effectively use and access financial services (Lyons & Kass-Hanna, 2021) to achieve financial well-being. For Micro, Small and Medium Enterprises (MSMEs), FL is vital for managing finances, accessing formal financial product, and developing strategies to mitigate financial risks and sustain business performance, especially during crises (OECD, 2023c). Financial Literacy Knowledge (FLK) refers to one's understanding of financial concepts, instruments, and practices, such as inflation, investing/savings, interest and risk (OECD, 2023b). Financial Literacy Behaviour (FLB) represents the actual financial practices of MSMEs, including payment, record keeping, use of insurance, financing, long-term planning and adaptation to external pressures (OECD, 2020b, 2023b). Furthermore, Financial Literacy Attitude (FLA) denotes beliefs and perspectives towards financial planning, financing and risk management (OECD, 2020b, 2023b).

DFL extends financial competencies into digital context, reflecting the ability to utilize digital technologies and financial services safely and effectively (OECD, 2024a). For MSME owners, DFL builds confidence and readiness to engage with diverse digital platforms, such as mobile and online financial services, electronic money, i-tellers, branchless banking, and other digital payment systems, thereby reducing barriers to financial access (Lyons & Kass-Hanna, 2021; OECD, 2023c, 2024a). Strengthening both financial and digital proficiency promotes broader financial inclusion and strengthens MSMEs' adaptability withing the rapidly digitalizing economy. Digital Financial Literacy Knowledge (DFLK) encompasses an understanding of digital financial instruments, digital contracts, data privacy and emerging assets like cryptocurrency (OECD, 2024a). Meanwhile, Digital Financial Literacy Behaviour (DFLB) reflects individuals' actions in managing digital financial decisions, such as safeguarding passwords, verifying the legitimacy of financial

service providers, and protecting personal financial information from public exposure (OECD, 2024a). Finally, Digital Financial Literacy Attitude (DFLA) captures individuals' perceptions towards digital financial decisions, including their sense of security in online transactions, caution regarding public Wi-Fi use, and attention to digital terms and conditions prior to purchase.

2.2. Determinants of Financial Literacy and Digital Financial Literacy

2.2.1. Demographic Factors

Following OECD (2023b) and OECD (2024a), the demographic factors that determine FL and DFL are gender, age, education, marital status, and employment. Men typically demonstrate higher financial knowledge, while women exhibit stronger financial attitudes, particularly towards saving and risk aversion (Potrich et al., 2018). Gender gaps in DFL persist due to unequal access to technology and financial services (Pattnayak & Sahoo, 2024; Ravikumar et al., 2022).

Age also influences literacy outcomes. Younger individuals tend to adopt digital finance more readily, whereas older cohorts rely more on traditional practices (Azeez & Akhtar, 2021). Education remains one of the strongest predictors of both FL and DFL, as it enhances cognitive ability and exposure to financial products (van Rooij et al., 2011).

Marital status and employment status also shape literacy outcomes. Unmarried individuals often display higher DFL levels, possibly due to greater financial independence and digital engagement (Chhillar et al., 2025). Stable employment, particularly in the public sector, is associated with higher financial literacy due to predictable income and access to formal financial systems (De Amorim Floriano et al., 2023). However, according to Janposri (2020), self-employed individuals often exhibit lower financial knowledge. Based on the relevant literature, the hypotheses are as follows:

- Ha₁ : Gender influences FL
- Ha₂ : Age negatively influences FL
- Ha₃ : Education positively influences FL
- Ha₄ : Marital status affects FL
- Ha₅ : A Permanent job positively affects FL
- Ha₆ : Gender affects DFL
- Ha₇ : Age negatively affects DFL
- Ha₈ : Education positively affects DFL
- Ha₉ : Marital status affects DFL
- Ha₁₀ : A Permanent job positively affects on DFL

2.2.2. Socioeconomics Factors

Socioeconomic factors, such as income, occupation, and household structure, significantly influence both FL and DFL. Higher and more stable income enables individuals to engage with financial products and invest in financial education (Grohmann et al., 2018). However, this relationship is complex and affected by other socioeconomic factors (Jagannathan et al., 2023). Income also shapes digital engagement, as higher-income individuals tend to use digital financial platforms more frequently, increasing familiarity and competence (Maladianti et al., 2024).

Family structure also plays a role. Larger households or those with more dependents may develop better budgeting skills, but they also face greater financial stress and lower digital competency (Ahmad & Mohamed Zabri, 2023). This dynamic effect of family structure influences the availability and quality of financial education and support within the family (Asadi et al., 2023). Social participation enhances literacy through knowledge diffusion and trust-building within communities (Marla et al., 2023). In Banda Aceh, for example, social capital, combined with digital finance, mediates the effects of Islamic financial literacy on financial inclusion (Marla et al., 2023). Community-based educational programmes, such as those in Pondok Pesantren, significantly improve digital financial literacy among students (Herlinawati et al., 2023). Drawing on the relevant literature, the following hypotheses are proposed:

Ha₁₁: Permanent job income has a positive effect on FL.

Ha₁₂: Household income has a positive effect on FL.

Ha₁₃: Number of dependents has a negative effect on FL.

Ha₁₄: Community has a positive effect on FL.

Ha₁₅: Permanent job income has a positive effect on DFL.

Ha₁₆: Household income has a positive effect on DFL.

Ha₁₇: Number of dependents has a negative effect on DFL.

Ha₁₈: Community has a positive effect on DFL.

2.2.3. Business Characteristics

Business characteristics, such as business type and business turnover, also influence literacy outcomes. Service sector enterprises tend to exhibit higher financial literacy than manufacturing enterprises (Anshika et al., 2021). Export-oriented MSMEs require both traditional financial management and digital financial platforms to support cross-border transactions (Awais et al., 2016). Business turnover can also enhance literacy, as entrepreneurial activities require financial decision-making and digital engagement (Xie & Chen, 2024).

Based on existing empirical evidence, the hypotheses are formulated as follows:

H_{a19}: Business type affects FL.

H_{a20}: Business turnover has a positive effect on FL.

H_{a21}: Business type affects the DFL.

H_{a22}: Business turnover has a positive effect on DFL.

2.2.4. Technology Proficiency

Technology proficiency, measured by internet access, use of online information, and ownership of digital payment tools, plays an increasingly important role in shaping literacy outcomes. Internet access broadens opportunities for financial education, while social media can enhance awareness through peer learning (Yang et al., 2023). Regular engagement with digital platforms improves access to financial information, fosters trust in digital services, and supports experiential learning (OECD, 2020c; S., 2022). However, adoption levels vary across regions depending on infrastructure and network coverage (Pradhan, 2024). Informed by the relevant body of literature, the following hypotheses are developed:

H_{a23}: Access to Wi-Fi has a positive effect on FL.

H_{a24}: Internet as an information resource has a positive effect on FL.

H_{a25}: Ownership of digital payment tool has a positive effect on FL.

H_{a26}: Access to Wi-Fi has a positive effect on DFL.

H_{a27}: Internet as an information resource has a positive effect on DFL.

H_{a28}: Ownership of digital payment tool has a positive effect on DFL.

2.2.5. Mediation Effects of Financial Literacy on Digital Financial Literacy

Existing studies suggest that the effects of demographic, socioeconomic, business, and technological factors on DFL may operate indirectly through FL. Financial knowledge, attitudes and behaviours developed through conventional financial experiences often serve as foundations for digital competence (Lusardi & Mitchell, 2014; Grohmann et al., 2018). For instance, individuals with strong financial knowledge are more confident in adopting digital tools, while sound financial attitudes and behaviours foster trust in online financial systems (Li, Chen, & Zhao, 2020). Accordingly, this study posits that FL mediates the relationship between background factors and DFL, leading to the following hypotheses:

H_{a29}: Financial literacy knowledge mediates the relationship between background factors and digital financial literacy knowledge

- H_{a30} : Financial literacy behaviour mediates the relationship between background factors and digital financial literacy behaviour
- H_{a31} : Financial literacy attitude mediates the relationship between background factors and digital financial literacy attitude

Figure 1. Conceptual Framework

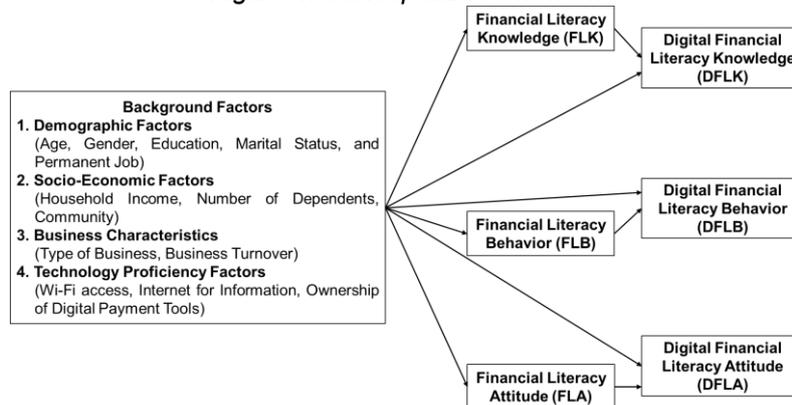


Figure 1 shows the relationship between variables based on the hypotheses. Background factors indirectly affect each dimension of financial literacy: knowledge, behavior, and attitude. Finally, background factors can also directly affect the DFL dimensions, namely knowledge, behavior, and attitude.

3. Research Methodology

3.1.1. Data

Following the rule of thumb for Partial Least Squares Structural Equation Modelling (PLS-SEM), the minimum sample size depends on the model

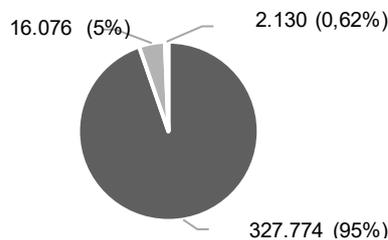
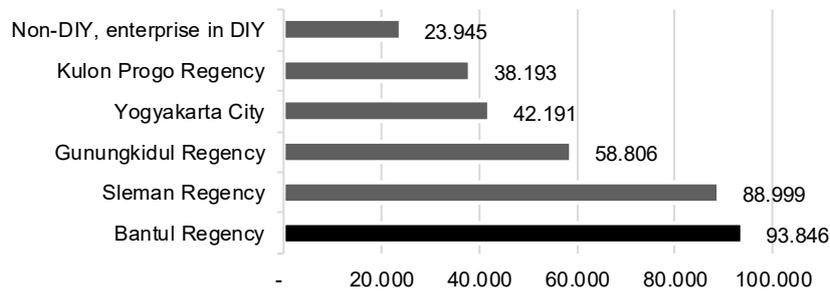


Figure 2. MSME Population by Enterprise Scale in 2021
Source: Sidakui Bantul. Sidakui (Sistem Informasi Data Perdagangan (2021)

complexity and the expected magnitude of path coefficients. According to Hair et al. (2019), a minimum of 112 observations is sufficient when the smallest expected path coefficient ranges between 0.21 and 0.30 at the 1% significance level. The population of MSMEs in the Yogyakarta Special Region (DIY) totals 345,980 units, with micro-scale enterprises comprising approximately 95% (see Figure 2).

Given their numerical dominance and economic importance, this study focuses exclusively on micro-scale MSMEs. Bantul Regency was purposively selected as the research site because it has the largest concentration of micro-scale enterprises in DIY as shown in **Error! Reference source not found.**

Figure 3. MSME Population by Districts in DIY 2021



Source: Sidakui Bantul. Sidakui (Sistem Informasi Data Perdagangan (2021))

Of the 163 questionnaires distributed across six districts, 155 were deemed valid and suitable for analysis (see Table 1).

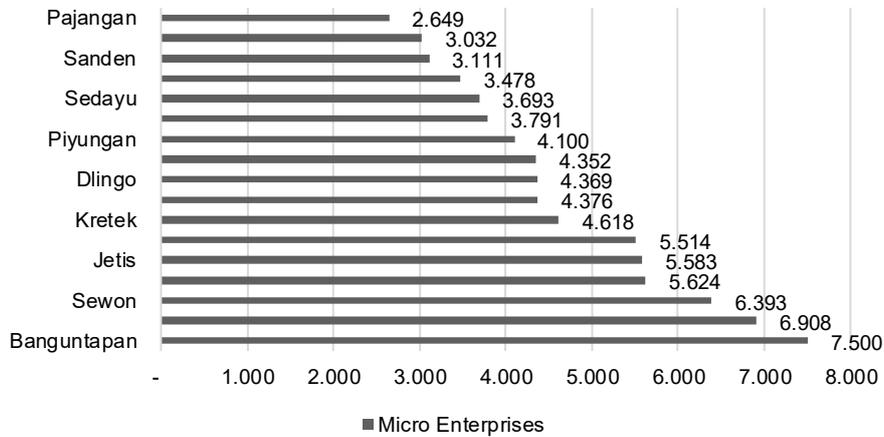
Table 1 Sample Distribution by District in Bantul Regency

District	Freq.	%
Banguntapan	33	21.29
Kasihlan	25	16.13
Sewon	8	5.16
Bantul	42	27.10
Jetis	12	7.74
Imogiri	35	22.58
Total	155	100

This exceeds the minimum PLS-SEM sample requirement, ensuring adequate statistical power and model estimation reliability. Because Bantul's MSME structure reflects the overall composition of micro-enterprises across DIY (see

Figure 4), the findings can be reasonably generalized to the wider regional MSME population.

Figure 4. Distribution of Micro Enterprises by District in Bantul Regency (2021)



Source: Sidakui Bantul. Sidakui (Sistem Informasi Data Perdagangan (2021))

3.1.2. Analytical Technique

Each indicator of FL and DFL, covering knowledge, behaviour, and attitude, was converted into a normalized score ranging from 0 to 100 to ensure comparability across dimensions. Both constructs (Table 14 and Table 15) adopt the tripartite structure of knowledge, behaviour, and attitude from OECD/INFE framework (OECD, 2023b, 2024a). For knowledge indicators, an incorrect answer received 0 points, while a correct answer received 100 points. Behaviour and attitude were measured using a five-point Likert scale, where responses of 1, 2, 3, 4 and 5 were converted to 0, 25, 50, 75 and 100, respectively. The average score for each dimension was then calculated to represent the levels of FL and DFL, with higher scores indicating greater literacy.

The relationships between demographic factors (Demo), socio-economic factors (Socio), business characteristics (Bus), technology proficiency (Tech) and financial and digital financial literacy (FL and DFL) were examined using path analysis within the SEM framework. The econometric specifications were estimated as follows:

$$DFLK = \beta_{10} + \sum_{k=1}^5 \beta_{1k} Demo_k + \sum_{l=1}^3 \beta_{1l} Socio_l + \sum_{m=1}^2 \beta_{1m} Bus_m + \sum_{n=1}^3 \beta_{1n} Tech_n + \beta_{14} FLK + \varepsilon_{10} \quad [1]$$

$$FLK = \delta_{11} + \sum_{k=1}^5 \delta_{1k} Demo_k + \sum_{l=1}^3 \delta_{1l} Socio_l + \sum_{m=1}^2 \delta_{1m} Bus_m + \sum_{n=1}^3 \delta_{1n} Tech_n + \varepsilon_{11} \quad [2]$$

$$DFLB = \beta_{20} + \sum_{k=1}^5 \beta_{2k} Demo_k + \sum_{l=1}^3 \beta_{2l} Socio_l + \sum_{m=1}^2 \beta_{2m} Bus_m + \sum_{n=1}^3 \beta_{2n} Tech_n + \beta_{24} FLB + \varepsilon_{20} \quad [3]$$

$$FLB = \delta_{21} + \sum_{k=1}^5 \delta_{2k} Demo_k + \sum_{l=1}^3 \delta_{2l} Socio_l + \sum_{m=1}^2 \delta_{2m} Bus_m + \sum_{n=1}^3 \delta_{2n} Tech_n + \varepsilon_{21} \quad [4]$$

$$DFLA = \beta_{30} + \sum_{k=1}^5 \beta_{3k} Demo_k + \sum_{l=1}^3 \beta_{3l} Socio_l + \sum_{m=1}^2 \beta_{3m} Bus_m + \sum_{n=1}^3 \beta_{3n} Tech_n + \beta_{34} FLA + \varepsilon_{30} \quad [5]$$

$$FLA = \delta_{31} + \sum_{k=1}^5 \delta_{3k} Demo_k + \sum_{l=1}^3 \delta_{3l} Socio_l + \sum_{m=1}^2 \delta_{3m} Bus_m + \sum_{n=1}^3 \delta_{3n} Tech_n + \varepsilon_{31} \quad [6]$$

Then, the indicators of each variable are presented in in

Table 2.

Table 2 The Indactors of Variables

Variables	Indicators
Demographic	Gender (GEN) Education (EDU) Marital Status (MAR) Having a Permanent Job (PERM)
Socio-economic	Having Permanent Job Income (PJINC) Household Income (HHINC) Number of dependents (DEP) Community Membership (COMM)
Business Characteristics	Business Type (BTYP; 1 = Retail, 0 = MSE) Business Turnover (TURN)
Technology Proficiency	Access to Wifi (WIFI) Internet use for Information (ININFO) Ownership of digital payment tools (DPTOOL)

Prior to estimating the structural model, multicollinearity was assessed using the Pearson correlation matrix. All correlation coefficients in Table 16 were below 0.80, indicating no multicollinearity among the predictors. Model fit was evaluated using the Standardized Root Mean Square Residual (SRMR) as the primary index. In

Table 2, an SRMR value of 0.037 (below the 0.08 threshold) indicates an acceptable model fit (Hair et al., 2019; Hair et al., 2021; Hair, Risher, et al., 2019). The Coefficient of Determination (CD) of 0.722 suggests strong structural validity and predictive strength.

Table 3. Fit Statistic

Fit Statistic	Value
Size of residuals	
SRMR	0.037
CD	0.722

At the equation level (Table 4), DFL constructs displayed higher explanatory power than FL constructs. Among the DFL dimensions, DFLA had the highest R^2 (0.333), followed by DFL (0.294) and DFLK (0.261). The R^2 values for FLK (0.214), FLB (0.164), and FLA (0.111) were lower, implying that additional unobserved factors may influence these dimensions.

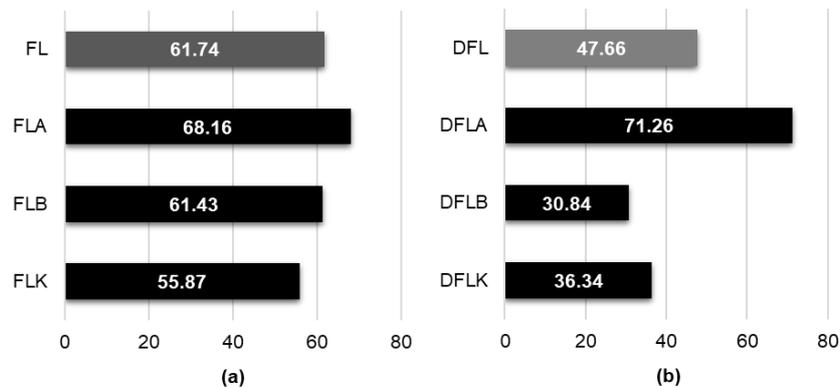
Table 4. Equation-level of goodness of Fit

Dependent Variables	R-squared
Observed	
FLK	0.214
FLB	0.164
FLA	0.111
DFLK	0.261
DFLB	0.294
DFL	0.333
Overall	0.722

4. Results and Discussion

4.1.1. Descriptive analysis

Figure 5. Average Scores of FL and DFL

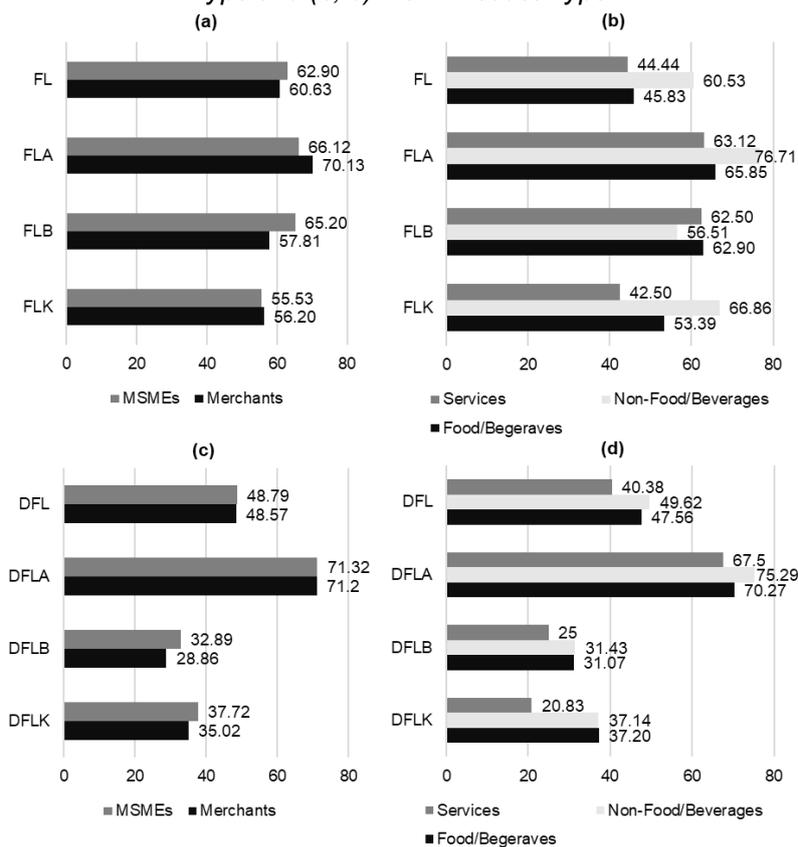


Source: Survey data, processed by the author (2025)

Figure 5 shows that the overall financial literacy (FL) score (61.74) is higher than the digital financial literacy (DFL) score (47.66). Among the three dimensions, the attitude dimension records the highest average score for both FLA (68.16) and DFLA (71.26), suggesting that MSME owners generally demonstrate positive attitudes towards financial and digital financial management. Conversely, the knowledge dimension shows the lowest score in FL (55.87), while for DFL, the lowest is observed in the behaviour dimension (30.84). This pattern indicates that although respondents possess favourable attitudes, their practical knowledge and behavioural application of financial and digital financial concepts remain limited. According to the OECD (2023), the

minimum target score is defined as achieving at least 70 points out of 100. Therefore, it can be concluded that the financial and digital financial literacy of MSME owner in the Special Region of Yogyakarta has not yet reached the OECD's minimum target benchmark.

Figure 6. Average Scores of FL (a, b) and DFL (c, d) based on (a, c) Business Type and (b, d) Main Product Type



Source: Survey data, processed by the author (2025)

Figure 6 further disaggregates the scores by business type and main product category. In terms of business type, MSMEs exhibit higher average FL and DFL scores compared to retail businesses, implying that more organized enterprises

tend to have stronger financial competencies. When classified by main product type, enterprises producing non-food and beverage products attain the highest FL and DFL scores, followed by those in the food and beverage sector, whereas service-based enterprises record the lowest scores. This finding suggests that product-based businesses may have more frequent exposure to financial transactions and digital tools compared to service providers.

4.1.2. FL and DFL

Table 5. Direct Effect of FL and DFL

	DFLK	DFLB	DFLA
FLK	0.157*		
FLB		0.192	
FLA			0.040

Notes: *, **, *** are significant at 10%, 5%, and 1%, respectively.

Based on the results from *Table 5*, FLK positively affects DFLK, indicating that an understanding of basic financial concepts enhance the comprehension of digital financial mechanisms (Hakim et al., 2025). However, FLK does not significantly influence DFLB or DFLA. This suggests that knowledge alone is insufficient to shape behaviour or perceptions towards digital finance, which are more strongly influenced by factors such as trust, technological access, and prior experience rather than conceptual understanding.

4.1.3. Demographic Factors on FL and DFL

Table 6. Direct Effect of Demographic Factors on FL and DFL

	FLK	FLB	FLA	DFLK	DFLB	DFLA
GEN	7.580*	1.132	-0.861	-3.233	2.998	0.353
AGE	-0.265	-0.166	0.002	-0.486*	-0.931***	-0.500***
EDU	19.454***	3.367	5.222	0.759	4.509	4.922**
MAR	-1.409	-11.079*	-3.487	-7.381	-1.516	8.014
PERM	-5.643	-6.543*	-2.736	-14.216***	-12.879**	-1.094

Notes: *, **, *** are significant at 10%, 5%, and 1%, respectively.

Table 7. Indirect Effect of Demographic Factors on FL and DFL

Observed	Coef.	Observed	Coef.	Observed	Coef.
GEN→FLK→DFLK	1.1926*	GEN→FLB→DFLB	-0.1100	GEN→FLA→DFLA	0.1719
AGE→FLK→DFLK	-0.0416	AGE→FLB→DFLB	-0.0262	AGE→FLA→DFLA	0.0004
EDU→FLK→DFLK	3.0608**	EDU→FLB→DFLB	-0.0105	EDU→FLA→DFLA	0.1586
MAR→FLK→DFLK	-0.2216	MAR→FLB→DFLB	0.1248	MAR→FLA→DFLA	0.4225
PERM→FLK→DFLK	-0.8878	PERM→FLB→DFLB	0.0069	PERM→FLA→DFLA	-0.4409

Notes: *, **, *** are significant at 10%, 5%, and 1%, respectively.

Based on the results in Table 6 and

Table 7, gender directly affects FLK and indirectly affects DFLK through FLK. Male MSE owners generally score higher in FLK than women across income, education levels, and countries (Bucher-Koenen et al., 2014; Hasler & Lusardi, 2017; OECD, 2023b), largely due to women's lower confidence and higher tendency to respond "do not know" despite similar actual knowledge (Bucher-Koenen et al., 2021; Potrich et al., 2018). Based on the survey, female owners dominated the "do not know" responses by 9.68%, compared to 2.45% for male owners. This may be affected by psychological and social factors, such as lower self-assurance in financial decisions, traditional gender roles (such as delegating financial decisions to their husbands), and limited exposure to financial management (Bottazzi & Lusardi, 2020; Davoli & Rodríguez-Planas, 2025; OECD, 2023b; Totolo et al., 2025). Thus, strengthening women's numerical and financial skills from an early age is crucial to foster long-term financial confidence and resilience (Davoli & Rodríguez-Planas, 2025; Iwatsubo et al., 2025; Potrich et al., 2018), especially given women's lower lifetime income, career interruptions, and longer life expectancy (Hasler & Lusardi, 2017; OECD, 2023b).

Age negatively affects all dimensions of DFL, indicating that older MSE owners tend to have lower levels of DFLK, DFLB and DFLA, compared to younger counterparts. Older individuals are generally less exposed to and less comfortable with digital financial technologies, often perceiving them as complex or of limited usefulness (OECD, 2023a, 2023b; Panetta et al., 2025). Cognitive decline with age may also reduce their ability and willingness to learn new digital tools, leading to lower engagement with online financial services such as mobile banking, e-wallets, and digital payments (Han & Ko, 2025). As a result, many older MSE owners rely on younger family members to manage digital transactions, maintaining a preference for cash-based and face-to-face financial interactions due to habit persistence and lower digital self-efficacy (Panetta et al., 2025). Therefore, it is essential to design age-inclusive digital financial education and platforms (Han & Ko, 2025), and mentoring programs to help older MSE owners adapt and remain competitive in an increasingly digital financial environment.

Education positively influences FLK and DFLA (van Rooij et al., 2011). Higher educational attainment enhances numeracy, reading comprehension, and critical-thinking skills, enabling individuals to better grasp financial concepts such as interest, inflation, and risk. Early exposure to financial education, supported by collaboration between schools and parents, helps children develop higher financial literacy (Lusardi & Messy, 2023; Saputra & Susanti,

2021). Those who often discuss money matters with their parents tend to show higher financial literacy (OECD, 2024b). In addition, MSE owners who have higher education and greater exposure to financial products have a better perception of digital financial literacy, including online security awareness, caution when using public Wi-Fi, and the careful review of digital transaction terms.

Marital status and having a permanent job both show a negative relationship with FLB. Unmarried individuals often display better financial habits and higher levels of financial behaviour compared to those who are married. This might be because single individuals usually have more freedom and personal responsibility in handling their money, which encourages them to build stronger financial knowledge and self-control (Chillar et al., 2024). Conversely, married individuals often face more complex financial commitments, such as shared household expenses, childcare, and long-term debt obligations, which can limit their financial flexibility and planning capacity. Differences in financial decision-making between spouses, unequal financial knowledge, and risk aversion to protect family stability may also weaken overall financial behaviour within the household (Novianti et al., 2024). Consequently, while marriage may bring financial stability through income pooling, it can also lead to lower MSE owner engagement and overly cautious financial management, thereby reducing proactive financial behaviours.

Regarding permanent jobs, MSE owners who have a permanent job outside their enterprise tend to demonstrate lower levels of financial behaviour than those without such employment. This finding contrasts with De Amorim Floriano et al. (2023) who found that stable employment could enhance financial management. MSE owners with permanent jobs outside their business may divide their time, attention, and motivation, reducing their engagement with digital financial services and resulting in weaker financial behaviour compared to those who rely solely on their enterprise (Jati et al., 2024; Verma et al., 2025). Furthermore, treating their MSE as a side business limits the time available to learn and apply DFLK, thereby contributing to lower DFLB, as these owners are less exposed and less able to practice using digital tools for their financial management.

4.1.4. Socio Economic on FL and DFL

Table 8. Direct Effect of Socio-Economic Factors on FL and DFL

	FLK	FLB	FLA	DFLK	DFLB	DFLA
PERMINC	-0.167	0.036	0.056	-0.512***	-0.449***	-0.096
HHINC	-0.066	0.187	0.035	-0.020	0.243	0.801***
DEP	0.793	-0.453	0.453	-4.513**	-0.310	-0.200

COMM	-7.969	4.801	-2.521	8.559	5.378	-6.403*
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Notes: *, **, *** are significant at 10%, 5%, and 1%, respectively.

Table 9. Indirect Effect of Socio-Economic Factors on FL and DFL

Observed	Coef.	Observed	Coef.	Observed	Coef.
PERMINC→FLK→DFLK	0.217	PERMINC→FLB→DFLB	0.036	PERMINC→FLA→DFLA	-1.254*
HHINC→FLK→DFLK	-0.032	HHINC→FLB→DFLB	-0.087	HHINC→FLA→DFLA	0.767
DEP→FLK→DFLK	0.647	DEP→FLB→DFLB	0.002	DEP→FLA→DFLA	-0.942
COMM→FLK→DFLK	-0.140	COMM→FLB→DFLB	0.011	COMM→FLA→DFLA	-0.101

Notes: *, **, *** are significant at 10%, 5%, and 1%, respectively.

Similar to having a permanent job, income from such permanent job is directly associated with lower DFLK and DFLB, and indirectly affects DFLA. Permanent jobs outside the enterprise provide a stable income, reducing the immediate need for MSE owners to optimize their business finances leading to lower digital financial behaviour and knowledge (Angeles, 2022; Jati et al., 2024; Rifqi & Nihayah, 2022). This suggests that MSE owners with stable income may prioritize their job security over improving their digital financial practices.

Meanwhile, MSE owners whose family members contribute additional income tend to have a higher DFLA. A family member's income can enhance household financial stability, lowering financial pressure and uncertainty, which in turn reduces financial stress. This financial security fosters a more positive mindset towards innovation and risk taking in adopting digital financial tools. Furthermore, if the family member actively uses digital financial services, MSE owners are more likely to develop positive perception of these tools' usefulness and safety. Consequently, they become more open and willing to engage with digital financial services, reflecting a higher DFLA.

The number of dependents negatively affects DFLK, contrasting with the findings of Zaimovic et al. (2025), who found that households of five or more members tend to use more financial products that improve their financial literacy. Based on the survey, only 18% of respondents reported using digital financial products. This limited adoption helps explain why MSE owners with a greater number of dependents tend to have lower DFLK scores, as their financial priorities are likely focused on household needs rather than on learning or adopting digital financial tools.

Similarly, community support negatively affects DFLA. MSE owners may feel less need to use digital financial tools or formal banking because their communities provide sufficient financial support. For instance, the local community may offer rotating savings and credit associations (ROSCAs),

lending circles, or opportunities to borrow from friends and family. This indicates that they tend to trust people they know more than anonymous online platforms (Siregar et al., 2025). To improve their digital financial literacy, the government, together with the formal banking sector, could educate MSE owners through their local communities, particularly regarding awareness, security, and risks in digital financial environments.

4.1.5. Technology Proficiency on FL and DFL

Table 10. Direct Effect of Technology Proficiency on FL and DFL

	FLK	FLB	FLA	DFLK	DFLB	DFLA
WIFI	1.008	3.993	-1.992	-3.638	1.280	-5.216**
ININFO	2.685	-4.903	-3.844	-1.626	-4.950	-0.714
DPTOOL	-2.802	-3.980	-4.866	-17.809***	-9.872*	-4.093

Notes: *, **, *** are significant at 10%, 5%, and 1%, respectively.

Table 11. Indirect Effect of Technology Proficiency on FL and DFL

Observed	Coef.	Observed	Coef.	Observed	Coef.
WIFI→FLK→DFLK	-0.035	WIFI→FLB→DFLB	0.312	WIFI→FLA→DFLA	-0.080
ININFO→FLK→DFLK	0.0001	ININFO→FLB→DFLB	0.003	ININFO→FLA→DFLA	-0.155
DPTOOL→FLK→DFLK	0.210	DPTOOL→FLB→DFLB	-1.137	DPTOOL→FLA→DFLA	-0.196

Notes: *, **, *** are significant at 10%, 5%, and 1%, respectively.

Regarding technological proficiency, although access to Wi-Fi facilitates digital connectivity, it does not necessarily foster a positive DFLA. Based on the survey, the lowest-scoring DFLA items were caution when using public Wi-Fi (48.87), website security awareness (68.87) and reading terms and conditions when purchasing online (67.26). This indicates that MSE owners with Wi-Fi access may exhibit lower awareness of security and privacy risks. Therefore, digital infrastructure must be accompanied by adequate literacy and risk awareness to translate into responsible financial attitudes, which in turn help the MSE owners avoid data breaches.

In terms of digital payment tools, 88.39% of respondents reportedly do not own digital payment accounts. This lack of ownership may explain why digital payment tools are associated with lower DFLK and DFLB among MSE owners. Based on the DFLK score, MSE owners' knowledge is very low in several areas: awareness of digital transaction legality (32.26), understanding of digital privacy risks (63.87), and knowledge of cryptocurrency (12.90). Similarly, their DFLB scores are low across all subdimensions: verification of provider legitimacy (50.97), digital financial tool usage (36.77), password and PIN security (20.00), financial privacy protection (40.65) and password

management practices (5.81). Limited exposure to digital financial services likely contributes to these low scores in both DFLK and DFLB. A practical recommendation is to mentor MSE owners in adopting digital financial tools, as guided support can enhance both their usage and understanding of these services. Affandi et al. (2024) found that adopting digital financial tools can potentially improve MSE owners' financial literacy. Mentoring could focus on familiarizing owners with mobile banking, e-wallets, secure password practices, and safe online transactions, which may increase their DFLK and DFLB through experiential learning (S., 2022).

4.1.6. Business Characteristics on FL and DFL

Table 12. Direct Effect of Technology Proficiency on FL and DFL

	FLK	FLB	FLA	DFLK	DFLB	DFLA
BTYP	1.984	-5.921*	4.278	-1.192	5.207	1.547
TURN	0.019	0.056	0.010	0.091***	0.055	-0.023

Notes: *, **, *** are significant at 10%, 5%, and 1%, respectively.

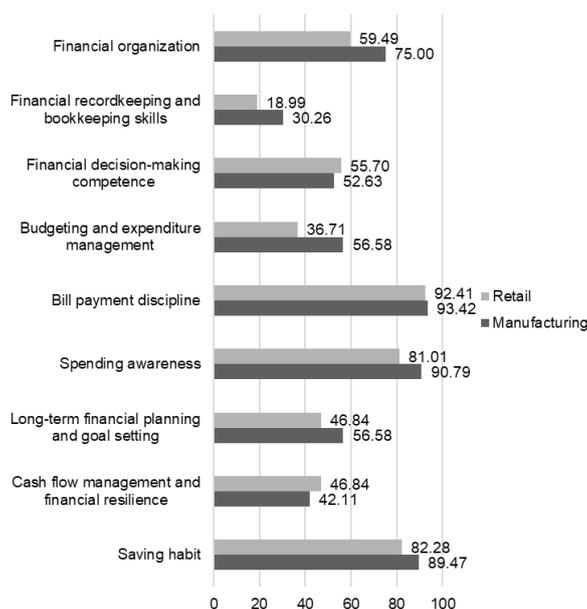
Table 13. Indirect Effect of Technology Proficiency on FL and DFL

Observed	Coef.	Observed	Coef.	Observed	Coef.
BTYP→FLK→DFLK	-2.128	BTYP→FLB→DFLB	0.001	BTYP→FLA→DFLA	-0.764
TURN→FLK→DFLK	-1.257	TURN→FLB→DFLB	0.018	TURN→FLA→DFLA	0.922

Notes: *, **, *** are significant at 10%, 5%, and 1%, respectively.

Retail MSEs have lower FLB compared to manufacturing MSEs. Unlike manufacturing enterprises that manage production cycles requiring structured financial planning, budgeting, and credit literacy, retail MSEs often operate in cash-based and informal systems with short-term financial orientations (Beck & Demircuc-Kunt, 2006). Based on the survey results (see Figure 7), retail MSEs demonstrate strong short-term financial responsibility, such as saving (82.28), bill payment (92.41), and spending awareness (81.01). However, their weaknesses lie in recordkeeping (18.99), budgeting and expenditure management (36.71), cash flow management (46.84), and long-term financial planning and goal setting (46.84). These patterns reflect limited competencies in budgeting, bookkeeping, and long-term financial planning, because retail MSEs tend to prioritize daily sales and liquidity rather than strategic financial management practices. Furthermore, the high level of informality in the retail sector also restricts access to formal credit and digital financial services, reducing opportunities to develop responsible financial behaviour.

Figure 7. Financial Literacy Behaviour based on Business Type



Source: Survey data, processed by the author (2025)

Nevertheless, MSE business turnover positively affects DFLK (Affandi et al., 2024; Totolo et al., 2025). Enterprises with higher turnover tend to have greater financial capacity, higher productivity, and more exposure to digital banking systems, which enhance their understanding of digital financial management (Totolo et al., 2025). Therefore, integrating daily MSE operations with supportive digital infrastructure can facilitate the adoption of digital financial technologies. This integration not only helps them to keep pace with rapid technological innovation but also contributes to improving their business performance and growth (Affandi et al., 2024).

5. Conclusion

5.1.1. Conclusion

This study finds that financial literacy (FL) and digital financial literacy (DFL) among micro-enterprise (MSE) owners in Yogyakarta remain below the OECD benchmark, particularly in knowledge and behavioural dimensions, despite generally positive attitudes. Several demographic factors significantly shape FL

and DFL outcomes: male, younger, and more educated MSE owners consistently demonstrate higher levels of literacy. Socio-economic characteristics also play a significant role. Having a permanent income job is associated with lower DFL, while contributions from family members help strengthen digital financial attitudes. In contrast, a larger number of dependents and reliance on community-based financial support tend to reduce engagement with digital financial tools. Business characteristics, such as business type and turnover, together with technology-related factors like internet access and ownership of digital payment tools, also influence FL and DFL. However, mere access to technology does not always translate into responsible digital financial behaviour. Importantly, FL serves as a mediating mechanism linking background characteristics to DFL, underscoring the essential role of foundational financial knowledge, attitudes, and behaviour in supporting digital financial adoption.

5.1.2. Recommendations

To improve FL and DFL among MSE owners, targeted financial education programs should be tailored to account for gender, age, and educational differences, emphasizing practical knowledge and behavioural application. Mentoring programs and workshops can guide owners in adopting digital financial tools, including mobile banking, e-wallets, secure password management, and safe online transactions, thereby fostering experiential learning. Collaboration between policymakers, financial institutions, and local communities is essential to build trust and expand outreach, particularly for older owners or those with more dependents who need inclusive and confidence-building support.

5.1.3. Limitations and Future Research

This study focuses exclusively on MSEs in Bantul Regency, which may limit its generalizability to larger enterprises across Yogyakarta. Data were collected through cross-sectional surveys, restricting the ability to capture temporal changes in financial literacy. While comprehension-based scoring improves measurement reliability, some behavioural and attitudinal responses may still be influenced by social desirability or self-report bias. In addition, the study did not explore the impact of broader institutional and regulatory factors, such as financial policies or digital infrastructure availability, which could affect FL and DFL outcomes.

Future studies could extend the analysis to include small- and medium-scale enterprises across multiple regions to enhance generalizability and capture

regional disparities in financial literacy. Further investigation into institutional and policy influences, as well as interventions such as gamified or community-based financial education, could provide deeper insights into improving digital financial literacy among MSMEs.

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APPENDICES

Table 14. Indicators of Financial Literacy

No.	Indicators	Mean
Financial Literacy Knowledge		
LK1	High inflation indicates that the cost of living is becoming more expensive.	50.97
LK2	An investment with a high rate of return/profit tends to carry a high level of risk	61.94
LK3	I will receive Rp 2,000,000. With inflation continuously increasing, one year from now...	86.45
LK4	You borrow Rp 1,000,000 from a friend. One (1) month later, you must repay the loan amounting to Rp 1,050,000. What is the interest rate on your loan for that one-month period?	29.03
LK5	You deposit Rp 1,000,000 in a bank with an annual interest rate of 10%. Assuming there are no administrative fees and taxes, how much will your savings amount to in one (1) year?	50.97
Financial Literacy Behaviour		
LK6	Do you plan your daily expenses?	46.45
LK7	I am the financial decision-maker in my family.	54.19
LK8	Do you record all of your expenses?	24.52
LK9	Do you allocate your income into different categories (for example, education, health, bill payments, etc.) at the beginning of each month or when you receive your salary/income?	67.10
LK10	Do you have savings?	85.81
LK11	Sometimes people find that their income is not sufficient to cover their living costs. In the past 12 months, has this happened to you personally?	44.52
LK12	Do you have savings targets at a bank/financial institution for the future (10–20 years from now)?	51.61
LK13	Before making a purchase, do you carefully consider whether you really need the item?	85.81
LK14	Do you pay your bills (electricity, water, internet, loan instalments, etc.) on time?	92.90
Financial Literacy Attitude		
LK15	If I have surplus money, I prefer to save it for the long term.	77.58
LK16	I like to allocate surplus money into various forms of assets/wealth.	90.97
LK17	I do not like using online loans or "pay later"/cash advance payment methods.	86.77
LK18	I am not interested in investment offers that promise high returns in a short period of time.	30.97
LK19	I believe in living for today, as tomorrow will bring its own fortune.	32.26

Table 15. Indicators of Digital Financial Literacy

Digital Financial Literacy Knowledge		
LKD1	Using digital financial applications does not require a paper contract signature to be considered valid.	32.26
LKD2	Personal data that I share publicly on social media can potentially be misused by others for financial or contractual transactions (e.g., online loans).	63.87
LKD3	Bitcoin and other cryptocurrencies are not universally recognized as legal payment instruments, and their use is limited and regulated in most countries.	12.90
Digital Financial Literacy Behaviour		
LKD4	Before purchasing an online financial product, I check and ensure that the provider is officially licensed or recognized by the Financial Services Authority (OJK).	50.97
LKD5	I have used digital financial applications such as mobile banking, e-wallets (e.g., Dana, OVO), or e-money (e.g., GoPay).	36.77
LKD6	I do not share my online account password and PIN with anyone; only I know them.	20.00
LKD7	I never share information about my financial condition on social media platforms such as Instagram stories, WhatsApp stories, or TikTok.	40.65
LKD8	I regularly change my passwords on websites/applications that I use for online transactions.	5.81
Digital Financial Literacy Attitude		
LKD9	Shopping online using public/free Wi-Fi is not safe, and I avoid doing so.	48.87
LKD10	It is important to pay attention to website security before making an online transaction.	68.87
LKD11	It is important to read the terms and conditions when purchasing products online.	67.26
LKD12	I avoid opening links from SMS or WhatsApp unless I am certain of their source.	83.23
LKD13	I am not easily tempted by prize lotteries or gift offers delivered through SMS, ads, or WhatsApp notifications.	88.07

Table 16. Multicollinearity Test Result

	GEN	AGE	EDU	MAR	PERM	PJINC	HHINC	DEP	BTYP	TURN	WIFI	ININFO	DPTOOL	COMM
GEN	1													
AGE	-0.2271	1												
EDU	0.0418	-0.2096	1											
MAR	-0.2621	0.4447	0.1387	1										
PERM	-0.0341	0.0844	-0.1527	0.0387	1									
PJINC	-0.0673	0.0361	0.0567	0.0188	-0.3437	1								
HHINC	-0.0428	0.0946	0.0595	0.0214	-0.0146	0.0476	1							
DEP	-0.0577	-0.1987	0.1518	0.1847	-0.0860	0.0138	-0.0460	1						
BTYP	-0.1391	0.2806	0.0408	0.0974	-0.0057	-0.0796	0.0565	-0.1696	1					
TURN	0.0873	0.0095	0.0673	-0.0375	-0.0324	0.0143	0.0000	0.0179	0.1226	1				
WIFI	0.0145	0.0407	-0.1372	0.0480	0.0964	0.0538	-0.0858	-0.1325	-0.0288	-0.0961	1			
ININFO	-0.0456	0.2735	-0.2064	0.0600	0.0975	0.0916	0.0806	-0.1416	0.0615	-0.0854	0.2953	1		
DPTOOL	0.0237	0.2532	-0.1291	0.0788	0.0901	-0.0631	0.0341	-0.1462	0.1138	-0.0932	0.2439	0.4675	1	
COMM	0.2904	-0.1611	-0.0991	-0.1943	0.0591	-0.0565	-0.1235	-0.0480	-0.1614	0.1290	-0.0737	0.0310	0.1008	1