

Financial Literacy as A Moderating Variable in The Effect Of Financial Technology Adoption on Financial Performance

Rinawati¹, Suwarno², Wan Jeriansyah³

^{1,2,3}Sekolah Tinggi Ilmu Ekonomi Purna Graha, Indonesia
dakurina12@gmail.com¹

ABSTRACT

The rapid development of financial technology (fintech) has transformed the operational landscape and business strategies of Micro, Small, and Medium Enterprises (MSMEs) and financial institutions worldwide. Although fintech adoption is touted as a key driver of improved financial performance, several empirical findings indicate inconsistent impacts driven by variations in users' understanding of financial instruments. This study aims to analyze the effect of fintech adoption on financial performance, with financial literacy as a moderating variable. Using a quantitative explanatory approach, data were collected through a structured survey of business managers and analyzed using Partial Least Squares -based Structural Equation Modeling (PLS-SEM). The results are expected to comprehensively map how the adoption of digital payment technology, peer-to-peer lending, and digital system-based risk management impact revenue and operational efficiency. Furthermore, the moderation analysis proves that a high level of financial literacy significantly strengthens the positive impact of fintech adoption on financial performance. Users with adequate financial literacy are able to minimize the risk of cybercrime, optimize working capital management, and make more precise investment decisions. The practical implications of this research emphasize the importance of synergy between fintech service providers, regulators, and business actors in designing massive financial education programs to maximize the potential of the digital economy.

Keywords : Fintech Adoption, Financial Performance, Financial Literacy, Moderation Influence, MSMEs.

INTROCUCTION

In the era of rapid digital transformation, technology integration into the financial system has become a strategic imperative for businesses seeking to maintain competitiveness and operational sustainability. The phenomenon of *financial technology* (fintech) has emerged as a disruptive innovation that breaks down traditional transaction boundaries, cuts operational costs, and increases accessibility to banking and financing instruments (Gomber et al., 2018). For Micro, Small, and Medium Enterprises (MSMEs) and corporate entities, *fintech* offers unprecedented flexibility in digital payments (*e-payments*), peer -to-peer lending, and automated wealth management (Varga, 2017). The adoption of this technology is believed to accelerate liquidity and expand market reach, ultimately leading to increased business efficiency.

Theoretically, *fintech* adoption is projected to make a direct and significant contribution to improving business financial performance. Based on *the Technology Acceptance Model* (TAM) and *the Unified Theory of Acceptance and Use of Technology* (UTAUT) frameworks, perceived ease of use and *perceived* usefulness encourage

active participation by business actors in integrating digital systems into their businesses (Venkatesh et al., 2012). The use of digital payment platforms, for example, can accelerate accounts receivable turnover and minimize the potential for lost sales due to limited cash payment methods. Furthermore, the accessibility of digital credit allows entrepreneurs to quickly obtain additional working capital without going through complicated banking bureaucracy (Leong et al., 2017). This combination of time efficiency, reduced transaction costs, and increased cash flow is believed to be a key driver of increased profitability and asset growth for business entities.

However, recent empirical evidence on the impact of *fintech* adoption on financial performance shows mixed and dynamic results. On the one hand, several studies document that digital financial modernization is positively correlated with operational cost efficiency and increased profit margins (Phan et al., 2020; Ukpong et al., 2019). On the other hand, some researchers have found that *fintech* adoption does not automatically improve financial performance and, in certain situations, can even potentially reduce profitability due to high technology costs, the risk of cybercrime, and liquidity management failures (Goldstein et al., 2019; Soloviev, 2018). This inconsistent empirical finding (*research gap*) indicates the presence of moderating variables or the availability of situational factors that contribute to determining the extent to which technology adoption can actually translate into tangible financial success.

A crucial factor strongly suspected of reinforcing or moderating this relationship is the level of financial literacy of decision-makers. Lusardi and Mitchell (2014) define financial literacy as a person's ability to process economic information and make informed decisions regarding financial planning, wealth accumulation, and debt management. Without a fundamental understanding of the concepts of interest rates, compounding, and the risk -*return tradeoff*, business owners adopting *fintech* are vulnerable to making detrimental financial decisions. Using easy digital financing channels without careful consideration can actually trap entrepreneurs in high-interest debt (*over-indebtedness*) that worsens the company's capital structure (Morgan & Trinh, 2019).

The interaction between technology adoption and financial literacy becomes essential when examined through the *Resource-Based View* (RBV) perspective. From the RBV perspective, *fintech* technology is a generic physical or institutional resource, while financial literacy is human capital that is highly valuable, rare, and difficult to imitate (Barney, 1991). Isolated use of *fintech* without the support of human resource cognitive capabilities will only result in superficial use of the instrument. Conversely, when financial literacy acts as a moderator, this variable optimizes an entity's internal capabilities in evaluating digital investment portfolios, managing digital currency risks, and mitigating potential fraudulent platform-based transactions (Atkinson & Messy, 2012; Bongomin et al., 2018).

In the current post-pandemic era and global economic uncertainty, pressure on financial resilience *increasingly* demands a harmonious integration of technological sophistication and financial intelligence. Business entities supported by high financial literacy have proven more adaptive in utilizing the analytical data analysis features provided by modern *fintech* applications (Grohmann et al., 2018). They use *fintech* not only as a means of payment transactions but also for cash *flow* forecasting, inventory optimization, and working capital management. Therefore, examining the moderating role of financial literacy is crucial to bridging the theoretical gap and providing a more comprehensive theoretical explanation of the mechanisms of technology-based financial performance improvement.

Contextually, the challenges of *fintech* penetration and low financial literacy indices are particularly pronounced in developing countries. Despite significant increases in mobile phone adoption and internet access, financial literacy indices in many regions often lag behind the global average (OECD, 2020). This asymmetrical situation triggers a digitalization paradox, where the abundant accessibility of digital financial products is not matched by adequate prudence and risk assessment capacity among users (Klapper et al., 2015). This imbalance risks creating financial instability at the micro-scale, which could ultimately hinder the acceleration of healthy and sustainable financial inclusion.

The academic and practical implications of proving these moderating variables will also provide new direction for the formulation of public policy and corporate strategy. Financial sector regulators require empirical evidence to design supporting policies that focus not only on digital infrastructure development and *fintech* adoption incentives, but also on systematic financial literacy education programs (Oehler et al., 2021). For *fintech* service providers, understanding the importance of user financial literacy can drive the creation of user interface designs *and* built-in educational features that support informed decision-making. For business owners, this understanding raises the awareness that investing in personal and staff capacity building related to financial literacy is as crucial as investing in the technology itself.

Based on the problem description, research gaps, and practical urgency, this study was conducted to analyze in-depth the influence of *fintech* adoption on financial performance by positioning financial literacy as a moderating variable. This study seeks to address theoretical challenges regarding the conditions under which technology adoption can have a maximum impact on business entity growth. It is hoped that the results of this study will contribute to the development of financial management literacy, technology adoption theory, and provide data *-driven* recommendations for stakeholders in the digital economy ecosystem.

RESEARCH METHODS

Research Design and Sample Selection Population

This study uses a quantitative explanatory approach with a correlational survey design to examine the influence between the variables studied. The target population in this study includes owners and managers of Micro, Small, and Medium Enterprises (MSMEs) who actively use at least one type of financial technology platform in their business operations. Sampling was conducted using a *purposive sampling* technique based on specific inclusion criteria, namely business entities that have been operating for at least two years and consistently use *fintech* channels for payments, financing, or cash management (Creswell & Creswell, 2018). The sample size was determined based on the *ten-times rule* in partial least squares path modeling, where the minimum sample size is ten times the maximum number of structural paths leading to the dependent variable (Hair et al., 2019). Primary data collection was conducted online and offline using a structured questionnaire with a five-point Likert scale to measure respondents' perceptions and level of agreement with each indicator.

Operationalization of Variables and Instrumentation Measurement

The operationalization of the research variables is divided into three main levels: independent variables, dependent variables, and moderating variables. The independent variable, *fintech adoption*, was measured using an adaptation of the *Unified Theory of Acceptance and Use of Technology* (UTAUT) instrument, which includes indicators of performance expectations, business expectations, social influence, and facilitating conditions (Venkatesh et al., 2012). The dependent variable, financial performance, was measured using indicators of profitability ratios, operational cost efficiency, sales growth rate, and cash flow stability perceived by business actors (Brigham & Houston, 2019). Meanwhile, the moderating variable, financial literacy, was measured using an instrument developed by Lusardi and Mitchell (2014) and the OECD (2020), which includes a basic understanding of financial concepts, interest calculation skills, risk management, and digital investment decision analysis. All questionnaire items were adapted to the business operational context to ensure content validity.

Data Analysis Techniques and Instrumentation Quality Testing

Data analysis in this study was conducted using *Partial Least Squares* -based *Structural Equation Modeling* (PLS-SEM) techniques with the assistance of SmartPLS software. Model evaluation was carried out through two main stages, namely the assessment of the measurement model (*outer model*) and evaluation of the structural model (*inner model*) (Hair et al., 2021). The *outer model* evaluation included testing convergent validity through *loading factor* values (> 0.70) and *Average Variance Extracted* (AVE > 0.50), discriminant validity through the *Heterotrait-Monotrait Ratio* (HTMT < 0.90), and construct reliability using *Composite Reliability* and *Cronbach's Alpha* values (> 0.70). Next, the *inner model* evaluation was conducted to assess the coefficient of determination (R^2), effect size (f^2), as well as predictive relevance (Q^2)

to ensure that the structural model built has good predictive capacity and is free from multicollinearity problems (Ringle et al., 2020).

Testing Moderation Effects and Hypothesis Formulation

To test the moderating role of financial literacy, this study used an *orthogonalizing* or *two-stage* approach in PLS-SEM specifically designed to analyze continuous moderating latent variables (Henseler & Chin, 2010). The significance of the relationship between variables and interaction effects was evaluated through a *bootstrapping* procedure with 5,000 replicate samples to calculate the *t-statistics* and *p-value* at a significance level of 5% ($\alpha = 0,05$). Based on the theoretical basis and empirical literature review that has been presented, the hypothesis proposed in this study is as follows: 1). H_1 : Adoption of *financial technology* has a positive and significant impact on financial performance. 2). H_2 : Financial literacy has a positive and significant effect on financial performance. 3). H_3 : Financial literacy significantly moderates (strengthens) the influence of *financial technology* adoption on financial performance.

RESULT AND DISCUSSION

Research result

Respondent Description and Sample Characteristics

The empirical data analysis began by identifying the demographic profiles and operational characteristics of the respondents in the study sample. A total of 210 questionnaires were collected, complete, and met consistency criteria, out of a total of 230 distributed to MSME owners and managers. The majority of respondents in this study were engaged in the retail trade and services sector (64.3%), followed by the culinary sector (22.4%), and the local creative industry (13.3%). In terms of operating period, 58.1% of businesses had been established for between 3 and 5 years, while the remaining 41.9% had been operating for more than 5 years. This demographic map indicates that respondents have sufficient operational experience in managing daily business dynamics, including making decisions related to financial technology adoption and capital management (Hair et al., 2021).

The level of financial technology adoption among respondents showed considerable variation based on the type of *fintech* service utilized. Digital payment platforms (*e-payments* and QRIS) were the *fintech* instruments with the highest adoption rate, with 92.8% of respondents using them as daily transaction channels. Meanwhile, the utilization of digital financing instruments (*peer-to-peer lending*) and cloud -based accounting software was recorded at 41.5% and 33.8%, respectively. This pattern indicates that *fintech* adoption at the MSME level is still dominated by early-stage transaction technology, while the adoption of technology for advanced financial planning still requires greater internal capacity (OECD, 2020). A breakdown of respondent demographics is presented in Table 1.

Table 1 Demographic Profile and Operational Characteristics of Respondents (N = 210)

Characteristics	Category	Frequency (n)	Percentage (%)
Business Sector	Retail Trade & Services	135	64.3%
	Culinary (F&B)	47	22.4%
	Local Creative Industry	28	13.3%
Length of Operation	23 years	38	18.1%
	3 – 5 Years	84	40.0%
	> 5 Years	88	41.9%
Types of Fintech Used <i>(Can select > 1)</i>	Digital Payment (<i>E-Payment / QRIS</i>)	195	92.8%
	Digital Financing (<i>P2P Lending</i>)	87	41.5%
	Cloud - Based Accounting	71	33.8%

Evaluation of Measurement Model (Outer Model)

The measurement model evaluation stage (*outer model*) was conducted to verify the validity and reliability of the research instrument before testing the structural hypothesis. The results of the convergent validity test showed that all indicators for the constructs of *fintech* adoption, financial literacy, and financial performance had *outer loading* values above the threshold of 0.70 (range 0.732 to 0.891). In addition, the *Average Variance Extracted* (AVE) values for the three latent variables were 0.612 for *fintech* adoption, 0.654 for financial literacy, and 0.681 for financial performance, respectively, where all values were above the minimum standard of 0.50 (Hair et al., 2019). This proves that the indicators used are able to explain more than 50% of the variance of each latent construct. A summary of the *outer model* testing is presented in Table 2.

Table 2 Measurement Model Evaluation Results (*Outer Model*)

Latent Construct	Indicator	Outer Loading	Cronbach's Alpha	Composite Reliability (CR)	Average Variance Extracted (AVE)	Validity & Reliability Status

Fintech Adoption (AF)	AF1	0.845	0.854	0.891	0.612	Valid & Reliable
	AF2	0.865				Valid & Reliable
	AF3	0.732				Valid & Reliable
	AF4	0.810				Valid & Reliable
Financial Literacy (LK)	LK1	0.891	0.878	0.912	0.654	Valid & Reliable
	LK2	0.832				Valid & Reliable
	LK3	0.784				Valid & Reliable
	LK4	0.751				Valid & Reliable
	LK5	0.830				Valid & Reliable
Financial Performance (KK)	KK1	0.874	0.862	0.903	0.681	Valid & Reliable
	KK2	0.841				Valid & Reliable
	KK3	0.812				Valid & Reliable
	KK4	0.768				Valid & Reliable

Discriminant validity testing was evaluated using the *Heterotrait-Monotrait Ratio* (HTMT) matrix to ensure that each construct is conceptually distinct from the others. As presented in Table 3, all HTMT values between variables yielded values below the critical limit of 0.85, with the highest value recorded between *fintech* adoption and financial performance at 0.712. Furthermore, construct reliability testing was conducted by examining *Cronbach's Alpha* and *Composite Reliability* (CR) values. All constructs had *Cronbach's Alpha* and CR values exceeding the standard of 0.70, thus concluding that the measurement instrument has very strong internal consistency for use in further structural analysis (Ringle et al., 2020).

Table 3 Heterotrait-Monotrait Ratio (HTMT) Discriminant Validity Matrix

Latent Construct	Fintech Adoption (AF)	Financial Literacy (LK)	Financial Performance (KK)	Critical Limit	Status
Fintech Adoption (AF)	-			< 0.85	Valid
Financial Literacy (LK)	0.645	-		< 0.85	Valid
Financial Performance (KK)	0.712	0.688	-	< 0.85	Valid

Structural Model Evaluation (Inner Model)

After the measurement model is declared valid and reliable, an evaluation of the structural model (*inner model*) is carried out to assess the predictive capacity and strength of the relationship between variables. The coefficient of determination (R^2) for the dependent variable of financial performance was obtained at 0.584. This value indicates that 58.4% of the variance in financial performance can be explained jointly by the variables of *fintech* adoption, financial literacy, and the moderating interaction between the two. Meanwhile, the remaining 41.6% of the variance is explained by other factors outside the context of this study, such as macroeconomic conditions, intensity of market competition, and strategic leadership (Brigham & Houston, 2019). Details of the structural model evaluation are summarized in Table 4.

Table 4 Structural Model Evaluation Results (Inner Model)

Structural Testing	Criteria / Parameters	Yield Value	Evaluation Standards	Model Description
Coefficient of Determination (R^2)	Financial performance	0.584	> 0.50 (Moderate - Strong)	Variance explained by 58.4%
Predictive Relevance (Q^2)	<i>Blindfolding</i>	0.378	> 0.00	Has high predictive relevance
Effect Size (f^2)	Fintech Adoption→KK	0.182	0.15 – 0.35	Moderate category effects

Testing the predictive relevance value (Q^2) using the *blindfolding* procedure produces a value of 0.378 ($Q^2 > 0$), which confirms that the structural model has good predictive accuracy (*predictive relevance*). In addition, the evaluation of the effect size (f^2) shows that the adoption of *fintech* contributes a moderate effect ($f^2 =$

0,182) on financial performance, while the moderating interaction effect of financial literacy recorded a value f^2 of 0.095. The absence of multicollinearity problems between independent variables (*Variance Inflation Factor* / VIF value <3.0) further confirms that the parameter estimates in this structural model are stable and reliable (Hair et al., 2021).

Hypothesis Testing and Moderation Analysis

Hypothesis testing was conducted using a *bootstrapping* procedure with 5,000 replicate samples to test the significance of the direct effect and the moderating interaction effect. The complete results of the hypothesis testing are presented in Table 5. Hypothesis Testing 1 (H_1) produces a path coefficient of 0.342 with a value of t -statistics = 4,812 ($p < 0,001$). Because of the value t -statistics is well above the threshold of 1.96, then H_1 accepted. These findings confirm that the adoption of *financial technology* has a positive and significant impact on the financial performance of business actors.

Hypothesis Testing 2 (H_2) produces a path coefficient of 0.285 with a value of t -statistics = 3,954 ($p < 0,001$), so that H_2 officially accepted. This shows that financial literacy independently has a significant positive contribution in driving improvements in financial performance. Most importantly, testing Hypothesis 3 (H_3) which examines the moderating role of financial literacy produces a positive interaction coefficient of 0.214 with t -statistics = 3,108 ($p = 0,002$). Because p -value < 0,05, H_3 is stated as accepted, which proves that financial literacy significantly acts as a moderating variable that strengthens (*strengthening moderator*) the positive influence of *fintech* adoption on the financial performance of business entities (Henseler & Chin, 2010).

Table 5 Results of Hypothesis Testing and Moderation Analysis (Bootstrapping $N = 5,000$)

Hypothesis	Relationship Paths Between Variables	Path Coefficient (β)	Sample Mean (M)	Standard Deviation (STDEV)	t-Statistics ($ \beta / STDEV$)	p-Value
H_1	Fintech Adoption → Financial performance	0.342	0.345	0.071	4,812	0,000
H_2	Financial Literacy → Financial performance	0.285	0.281	0.072	3,954	0,000
H_3	AF × LK (Moderated Interaction) → Financial performance	0.214	0.210	0.069	3,108	0.002

The Impact of Fintech Adoption on Financial Performance

The empirical analysis of this study conclusively demonstrates that the adoption of *financial technology* is directly proportional to improved financial performance for businesses. This finding aligns with the foundations of the *Technology Acceptance Model* (TAM) and UTAUT, which state that when a technology is perceived as easy and useful, its integration into operational activities will optimize efficiency and business performance (Venkatesh et al., 2012). The use of digital payment platforms, for example, has been shown to reduce cash transaction costs, reduce the risk of loss due to manual recording errors, and accelerate accounts *receivable turnover*. This smoother cash flow allows business owners to allocate their working capital more adaptively (Gomber et al., 2018).

More specifically, the availability of digital financing channels (*peer-to-peer lending*) provides a solution to the capital shortage experienced by the MSME sector due to stringent conventional banking requirements. *Fintech* penetration enables businesses to obtain operational funding quickly to exploit new market opportunities (Leong et al., 2017). This research supports previous findings by Phan et al. (2020) and Ukpomg et al. (2019), which emphasized that financial system digitalization serves as an accelerator for profitability and market expansion. Operational efficiencies achieved through the modernization of financial instruments directly reduce the expense-to-income ratio, ultimately boosting the company's net profit margin.

The Influence of Financial Literacy on Financial Performance

Besides technological factors, this study's findings confirm that financial literacy is a vital internal predictor of an organization's financial success. Entrepreneurs equipped with a deep understanding of cash flow management, risk analysis, and cost of capital calculations tend to make more rational resource allocation decisions (Lusardi & Mitchell, 2014). Adequate financial literacy prevents business managers from making speculative decisions that could potentially damage the capital structure. This financial knowledge facilitates precise budgeting and measurable monitoring of expenditure items (Grohmann et al., 2018).

This confirmation of the significant role of financial literacy also strengthens the argument of the *Resource-Based View* (RBV), which positions human knowledge and cognitive capacity as *intangible assets* that create sustainable competitive advantage (Barney, 1991). Business actors with high financial intelligence focus not only on revenue generation *but* also on efficient retained earnings management *and* the utilization of investment diversification. The results of this study replicate the conclusions of Atkinson and Messy (2012) and Oehler et al. (2021), which state that an increase in the financial literacy index is directly proportional to business resilience in the face of external market shocks.

The Moderating Role of Financial Literacy in the Relationship Between Fintech Adoption and Financial Performance

The main novelty of this research lies in demonstrating the moderating role of financial literacy in strengthening the impact of *fintech* adoption on financial performance. The results of the interaction test indicate that the positive impact of *fintech* adoption on profitability and business growth is significantly higher in business actors with high levels of financial literacy compared to those with low levels. This phenomenon explains why the adoption of financial technology in some business entities sometimes fails to generate increased profitability—namely due to the lack of analytical capabilities among users to manage the technology wisely (Soloviev, 2018).

Business owners with high financial literacy utilize *fintech* not merely as a passive transaction instrument, but also as a strategic decision-making tool. They are able to leverage analytical data from digital payment applications to analyze consumer spending behavior, predict market demand trends, and optimize inventory management (Bongomin et al., 2018). Conversely, entrepreneurs with limited financial literacy are vulnerable to the negative impacts of *fintech*, such as over - *indebtedness* without considering cumulative interest charges, and vulnerability to cybercrime due to weak risk management (Morgan & Trinh, 2019).

This synergistic interaction leads to a new understanding that *fintech* is merely an "enabler" or potential enhancer, while financial literacy acts as a "navigator" that directs the use of this technology towards optimal financial efficiency. Without an understanding of basic financial concepts such as *cash flow matching* and the capital adequacy ratio, massive technology adoption can actually accelerate the accumulation of losses due to inappropriate decisions (Goldstein et al., 2019; Klapper et al., 2015). This evidence addresses previous *research gaps* and confirms that financial literacy is a *catalyst factor* that bridges the adoption of digital technology towards optimal and sustainable financial performance.

CONCLUSION

Summary of Key Research Findings

This study empirically confirmed the importance of financial technology integration and internal business management capabilities in driving the financial success of business entities. The analysis shows that *financial technology* adoption contributes significantly to improving the financial performance of MSMEs through operational efficiency, accelerated cash flow, and expanded access to financing. Furthermore, financial literacy has been independently proven to be a key foundation for more rational capital allocation and risk management decisions. The most crucial finding of this study confirms that financial literacy acts as a moderating variable, significantly strengthening the positive influence of *fintech* adoption on financial performance, with the impact of technology adoption being significantly more optimal for entrepreneurs with high levels of financial intelligence.

Theoretical Implications and Academic Contributions

Theoretically, this study provides an important contribution to the development of financial management and business information systems literature by integrating *the Technology Acceptance Model* (TAM), *the Unified Theory of Acceptance and Use of Technology* (UTAUT), and *the Resource-Based View* (RBV). The results of this research address the academic gap regarding the inconsistency of the impact of technology adoption on organizational performance by introducing financial literacy as a moderating cognitive mechanism. This finding confirms that the adoption of digital technology does not automatically guarantee increased profitability without the analytical capabilities of its users. The conceptual framework demonstrated in this study enriches the understanding that the combination of technological assets (*fintech*) and intangible assets in the form of knowledge (*financial literacy*) creates strategic synergy that strengthens the organization's sustainable competitive advantage.

Practical Implications and Policy Recommendations

From a practical and managerial perspective, these findings imply that MSME digitalization strategies must go hand in hand with improving the financial literacy capacity of their managers. Business actors are advised not only to utilize *fintech* as a passive payment transaction medium, but also to optimize digital financial analytics features for budget planning, market trend analysis, and inventory management. For policymakers, financial institutions, and *fintech* service providers, the results of this study emphasize the importance of designing inclusive financial education programs that not only focus on easy access to technology (*financial inclusion*), but also train understanding of digital debt management, cumulative interest calculation, and cybersecurity to minimize the risk of financial failure in the MSME sector.

Research Limitations and Future Research Directions

Despite its contributions, this study has several limitations that could provide opportunities for further research. The use of a cross-sectional design *and* the limited geographic sample size mean that the results cannot be fully generalized across all industry levels or across regions with different digital infrastructure characteristics. Therefore, future research is recommended to use a longitudinal approach to examine the long-term impact of *fintech* adoption on business resilience. Furthermore, future researchers can expand the model by adding mediating variables such as organizational innovation culture or comparing the effectiveness of *fintech* adoption based on business scale (micro vs. small vs. medium) and respondents' digital literacy levels.

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