

Bridging Innovation and Digitalization: The Critical Role of Digital and Financial Literacy in Indonesian SME's

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Abstract: This study examines how digital and financial literacy support the digital transformation of Indonesian SMEs. It explores the roles of owners' attitudes toward digital innovation, business complexity, growth orientation, government intervention, and business networking in influencing SMEs' digital intensity, with digital and financial literacy serving as mediating factors. Using a quantitative approach and Structural Equation Modeling (SEM), data were collected from SMEs across Indonesia. The findings show that owners' attitudes toward digital innovation, growth orientation, and business networking significantly enhance SMEs' digital intensity through digital literacy, while business complexity and government intervention do not. Through financial literacy, growth orientation, government intervention, and business networking also have significant positive effects on digital intensity, whereas business complexity remains insignificant. Overall, the results highlight the crucial role of digital and financial literacy in accelerating the digital transformation and competitiveness of Indonesian SMEs.

Keywords: digital transformation, digitalization, small business, digital intensity, digital innovation

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INTRODUCTION

Economic growth remains a long-standing macroeconomic concern in which Small and Medium Enterprises (SMEs) play a central role. While SMEs are key drivers of economic development, they face substantial challenges, particularly the absence of clear and reliable financial information that limits lenders' capacity to properly evaluate their financial conditions (Siagian et al., 2024). This information gap, together with insufficient collateral and weak financial management practices, often discourages banks from providing credit to

SMEs and increases their likelihood of loan default (Anshika et al., 2021). Furthermore, in many developing countries, SMEs experience serious financing constraints due to low financial literacy, which restricts their access to funding and ultimately undermines their growth potential and long-term sustainability (M et al., 2024).

Small and medium-sized enterprises (SMEs) encounter numerous external constraints, such as complicated regulatory frameworks, taxation issues, and restricted access to technical know-how, all of which hinder their development and performance. In addition, support from government bodies, financial institutions, and large corporations is often insufficient, limiting SMEs' capacity to contribute more fully to economic growth (Atkinson, 2017). Their involvement in Global Value Chains (GVCs) is also constrained by limited resources, particularly inadequate access to finance, technology, and managerial capabilities (Elshaarawy & Ezzat, 2023). Advances in internet connectivity and digital technologies have created new opportunities for SMEs to strengthen competitiveness, reach international markets, and improve productivity (Sudrajad et al., 2023). Nevertheless, SMEs in developing economies generally adopt e-commerce more slowly than those in developed nations. This gap is largely driven by obstacles such as weak information technology infrastructure, regulatory and legal challenges, and insufficient digital competencies (Indiani et al., 2025). In the context of Industry 4.0, SMEs are increasingly required to adopt emerging technologies to remain competitive. Although prior research has extensively examined determinants of e-commerce adoption, much of it has concentrated on technology administrators, with relatively limited attention given to the perspectives of SME owners or managers (Jamwal et al., 2026; Karuppiyah et al., 2023).

Recent studies emphasize the growing significance of digital and financial literacy in enhancing the performance and digital adoption of small and medium-sized enterprises (SMEs). Although digital strategies, organizational practices, and information technology capabilities are widely recognized as critical enablers of new venture digitalization, the specific contribution of financial literacy within this context has not been fully clarified (Nugraheni et al., 2025). Nevertheless, evidence shows that techno-financial literacy can strengthen SME performance and improve risk management practices (Kulathunga et al., 2020). Moreover, access to digital financial services has been shown to mediate the relationship between financial literacy and SME performance, with mobile money serving as a dominant digital financial tool for SMEs in Ghana (Frimpong et al., 2022). Existing literature indicates that both digital and financial literacy are essential for improving SME outcomes in an increasingly digital economy. Financial literacy, in particular, supports sound financial decision-making, which directly influences SMEs' growth prospects and competitive advantage (Mohamed et al., 2024). Building on this perspective, the present study seeks to examine the effects of digital and financial literacy on the digital transformation of SMEs in Indonesia. The analysis considers key determinants such as owners' attitudes toward digital innovation, business complexity, growth orientation, government intervention, and business networking. In addition, the study investigates the mediating roles of digital and financial literacy within the digital transformation process. By applying a quantitative methodology using Structural Equation Modeling (SEM), the research aims to identify the primary drivers of digital engagement among SMEs and to clarify how digital and financial literacy may either strengthen or constrain these relationships. The findings are expected to inform policy

recommendations and provide practical insights for designing targeted training programs that support SMEs in enhancing their digital competitiveness and long-term sustainability.

This research advances understanding of the ways Indonesian SMEs can address obstacles to technology adoption while strengthening their ability to invest in and sustain digital initiatives. During the COVID-19 pandemic, many SMEs in Indonesia relied on a combination of offline and online marketing approaches to continue operating and to speed up their digital transformation processes (Kurniawati et al., 2021; Novia Rizki & Kurniawati, 2022). As awareness among Indonesian SMEs grows regarding the strategic importance of technology for business expansion, this study offers meaningful insights into how digital and financial literacy can support transformation efforts and increase SMEs' engagement in global markets. The study seeks to analyze the mediating roles of digital and financial literacy in shaping the effects of innovation, business complexity, networking, and government intervention on the digital intensity of SMEs. By examining these interconnections, the research contributes to a deeper understanding of how SMEs' digital transformation can be strengthened, how their competitiveness can be sustained, and how policymakers can design and implement policies that promote a supportive and inclusive digital ecosystem for SMEs.

LITERATURE REVIEW

Entrepreneurial Value Creation Theory

The entrepreneurial journey begins when an entrepreneur recognizes opportunities in the external environment and mobilizes available resources to develop targeted entrepreneurial capabilities. When required, additional resources are acquired to generate sustainable value and achieve long-term returns from entrepreneurial efforts (Eller et al., 2020). In this process, opportunities are reshaped to build distinctive competencies that offer competitive advantages. These competencies emerge from the integration of existing resources with reconfigured opportunities and are often demonstrated through a proof of concept. Entrepreneurs must make critical decisions concerning intellectual property protection, experimental approaches, resource mobilization, team composition, and financing strategies. To address these challenges, a contingent strategy is proposed that helps entrepreneurs align their underlying value logic with the most appropriate strategic actions, thereby providing essential guidance for future decision-making in an area that remains insufficiently explored in existing research (Wuebker et al., 2023). In parallel, digital transformation has become a crucial determinant of survival and value creation for small and medium-sized enterprises (SMEs). Empirical evidence indicates that the adoption of digital technologies can strengthen economic sustainability, generate social value, and improve overall organizational performance. A comprehensive framework for planning digital transformation in SMEs encompasses technological adoption, value generation, organizational change, operational adjustments, and financial planning considerations (Vrontis et al., 2022).

This research employs Entrepreneurial Value Creation Theory to examine the mechanisms through which SMEs create value in the context of digital transformation. It highlights the mediating roles of digital and financial literacy in shaping the effects of innovation, business complexity, and networking on the intensity of digitalization. The study

underscores how entrepreneurs strategically utilize resources, develop capabilities, and respond to external conditions to strengthen competitiveness and support sustainable long-term business growth (Zahoor et al., 2023).

Technology Acceptance Model

The Technology Acceptance Model (TAM), introduced by Davis (1989), was designed to explain and predict the acceptance, adoption, and use of information technology. The model is built around two core constructs, perceived usefulness and perceived ease of use, which help clarify the factors influencing the implementation of information systems (IS). A thorough understanding of these dimensions enables organizations, particularly in educational contexts, to optimize the benefits gained from information technology adoption (Zaineldeen et al., 2020). Recent studies highlight the growing importance of digital transformation (DT) for small and medium-sized enterprises (SMEs), while also recognizing the complexities and challenges involved in its implementation. To address these issues, frameworks have been developed to evaluate SMEs' readiness for digital transformation, stressing the importance of incorporating non-technological elements into the assessment process (Silva et al., 2023). Furthermore, review studies on e-commerce adoption among SMEs that apply TAM reveal an increasing tendency to extend the model by incorporating external variables (Hadian et al., 2023). TAM provides a theoretical basis for understanding how perceptions of usefulness and ease of use influence technology adoption. Through their mediating roles between innovation, complexity, and networking, digital and financial literacy strengthen SMEs' readiness to adopt digital technologies, support more effective digital transformation, and enhance competitiveness within an increasingly digital economic environment (Nurqamarani et al., 2021).

Social Network Theory

Social network theory focuses on understanding the structure and dynamics of relationships among individuals and groups. Empirical evidence demonstrates that these relational patterns significantly influence multiple domains of life, including education, health, and behavior (Broda et al., 2021). The theory draws on insights from diverse disciplines such as sociometric analysis, studies of interpersonal interaction, and ethnographic research (Liu, 2023). Core concepts in social network analysis include centrality, cohesion, and structural equivalence, while network characteristics are commonly measured through indicators such as degree, closeness, and betweenness. Social networks are often represented graphically, where nodes represent actors and ties illustrate the relationships between them. Such visualizations help reveal patterns of influence that may extend across several degrees of separation (Yamini et al., 2024).

Recent studies on digital transformation in small and medium-sized enterprises (SMEs) have identified key defining features of this process, yet the literature highlights a lack of comprehensive, step-by-step guidance to support SMEs, particularly in navigating digital transformation pathways (Hu et al., 2024). Building on Social Network Theory, this study examines how business networking shapes SMEs' digitalization intensity. Robust networks enable access to critical resources, knowledge, and support that facilitate digital

adoption. Digital and financial literacy are positioned as mediating factors in this relationship, enabling SMEs to effectively leverage their networks to manage complexity, foster innovation, and achieve sustainable growth within an increasingly competitive business environment (Tariq et al., 2024).

RESEARCH METHOD

This study adopts a quantitative research approach using a structured questionnaire to collect data from SMEs. The questionnaire, based on established measurement scales, is distributed online via email and directly to selected respondents (Sekaran, 2016). The study uses Structural Equation Modeling (SEM) with the Partial Least Squares (PLS) approach to analyze the relationships among the proposed variables. This method is appropriate for testing the research hypotheses and examining the relationships between constructs based on the underlying theoretical framework (Zeng et al., 2021).

The study relies on primary data obtained through field surveys using original data collection instruments (Zeithaml et al., 2020). The unit of analysis is defined as aggregated data collected over a given time frame. In this research, the unit of analysis comprises digitalized Micro, Small, and Medium Enterprises (MSMEs) in Indonesia, indicating that the organizational level serves as the focus of analysis (Sekaran, 2016). Accordingly, the respondents are MSME owners or business operators whose enterprises have adopted digital technologies. The proposed hypotheses are presented as follows: This study examines the indirect effects of several organizational and external factors on SMEs' digital intensity through the mediating roles of digital and financial literacy. Specifically, it investigates whether digital literacy mediates the relationships between owners' attitudes toward digital innovation, business complexity, growth orientation, government intervention, and business networking and SMEs' digital intensity. In addition, the study examines whether financial literacy, through the perception of digital benefits, mediates the relationships between business complexity, growth orientation, government intervention, and business networking and SMEs' digital intensity. These hypotheses provide a comprehensive framework for understanding how digital and financial literacy influence the digital transformation of Indonesian SMEs.

Entrepreneurial Value Creation Theory provides the overarching theoretical foundation for explaining how SMEs transform entrepreneurial conditions, resources, and opportunities into value through digital transformation. In the proposed model, Owner Attitude towards Digital Innovations (OADI), Business Complexity (BC), Growth Orientations (GO), and Government Intervention (GI) represent important entrepreneurial and contextual conditions that influence the development of organizational capabilities. Meanwhile, Business Networking (BN) represents relational resources that enable SMEs to access knowledge, information, expertise, and other resources. Consistent with Entrepreneurial Value Creation Theory, these conditions do not automatically generate digital value; rather, they must be translated into relevant capabilities that allow entrepreneurs to identify opportunities, mobilize resources, and reconfigure existing resources. In this process, Digital Literacy (DL) and Financial Literacy for Perception to Digital Benefit (FLDB) function as important capability mechanisms. Digital literacy enables SMEs to understand and utilize digital technologies, whereas financial literacy enables entrepreneurs to evaluate the economic benefits, costs, risks, and potential returns associated with digitalization. Thus, the

model conceptualizes digital transformation as a process through which entrepreneurial and relational resources are converted into capabilities that facilitate value creation and ultimately increase SMEs' Digital Intensity (SDI).

The Technology Acceptance Model (TAM) and Social Network Theory further complement Entrepreneurial Value Creation Theory by explaining the specific mechanisms underlying technology adoption and resource acquisition. TAM suggests that the acceptance and use of technology are influenced by perceptions of its usefulness and ease of use. In the present model, Digital Literacy strengthens SMEs' ability to understand, evaluate, and effectively use digital technologies, thereby supporting greater digital adoption and intensity. FLDB extends this logic by emphasizing the entrepreneur's ability to recognize and assess the financial benefits of digital technologies, strengthening the perceived usefulness of digitalization from an economic perspective. Meanwhile, Social Network Theory explains the role of Business Networking in facilitating access to knowledge, technological information, business experience, and external support, which can subsequently strengthen both digital and financial literacy. Accordingly, the integrated theoretical framework proposes that entrepreneurial and relational resources contribute to capability development, capability development enhances the recognition and utilization of digital value, and these processes ultimately increase SMEs' digitalization intensity. This integration positions Entrepreneurial Value Creation Theory as the overarching framework, TAM as the technology-acceptance mechanism, and Social Network Theory as the relational-resource mechanism underlying SMEs' digital transformation.

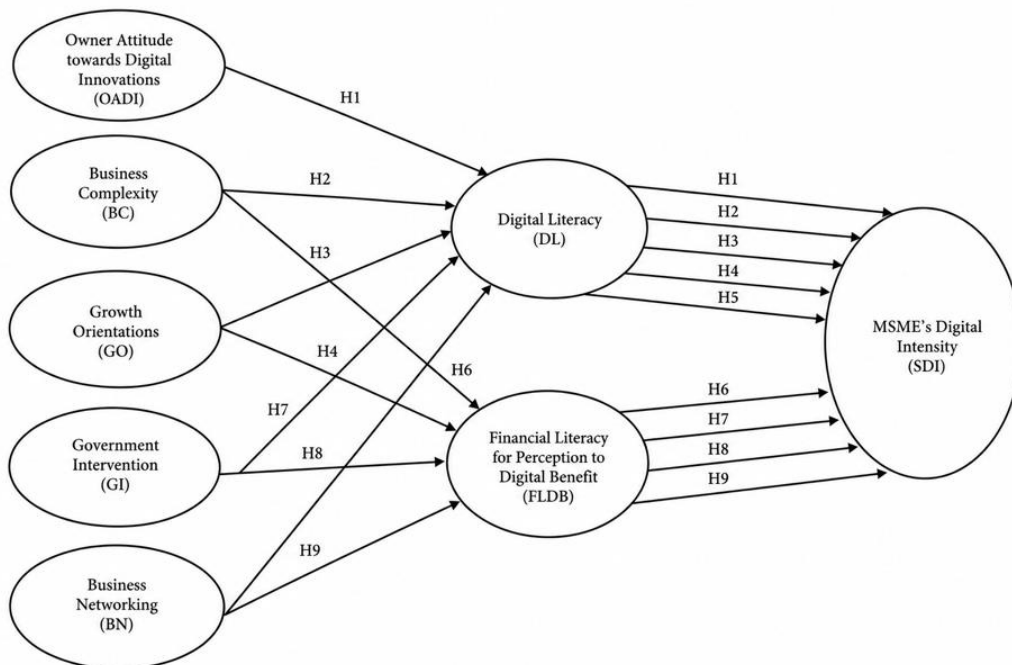


Figure 1. Conceptual framework

Figures 1 present a conceptual overview of how owners' attitudes toward digital innovation, business complexity, growth orientation, government intervention, and business networking serve as critical determinants of the growth and digitalization of small and medium-sized enterprises (SMEs) in Indonesia. The conceptual model positions Digital

Literacy (DL) and Financial Literacy for Perception to Digital Benefit (FLDB) as two distinct mediating mechanisms through which entrepreneurial, organizational, institutional, and relational factors influence SMEs' digital intensity. Digital Literacy represents the technological capability of SME owners or managers to understand, evaluate, adopt, and effectively utilize digital technologies in business activities. In the model, OADI, BC, GO, GI, and BN are expected to contribute to the development of this capability. A positive attitude toward digital innovation can encourage greater willingness to learn and use digital technologies, while business complexity and growth orientation create stronger demands for digital capabilities. Government intervention can provide training, infrastructure, and other forms of support, whereas business networking facilitates access to technological knowledge, information, and experience. Consequently, DL serves as the mechanism that converts these antecedent conditions into the practical capability required for digital transformation. Its relationship with SME's Digital Intensity (SDI) is consistent with the Technology Acceptance Model, because greater digital capability can improve an SME's ability to recognize the usefulness and ease of using digital technologies, thereby encouraging more intensive digital adoption. FLDB, meanwhile, represents a complementary but conceptually different mechanism. Rather than focusing primarily on the ability to use digital technology, FLDB captures the SME's ability to recognize, understand, and evaluate the financial benefits generated by digitalization. Business complexity, growth orientation, government intervention, and business networking may strengthen this financial capability by increasing the need for financial evaluation, providing access to financial knowledge, and exposing entrepreneurs to information about the economic benefits of digital technologies. FLDB therefore mediates the process through which these conditions are translated into greater SDI by helping entrepreneurs assess whether digital investments can generate efficiency, revenue growth, cost reduction, profitability, and long-term business value. From the perspective of Entrepreneurial Value Creation Theory, DL and FLDB represent two complementary capabilities for converting resources and opportunities into value: DL enables SMEs to use digital technology, while FLDB enables them to recognize and evaluate the financial value of using that technology. Accordingly, the model proposes two distinct mediation pathways—antecedent factors → DL → SDI and antecedent factors → FLDB → SDI—with DL emphasizing digital capability and FLDB emphasizing financial value recognition. Importantly, because the current conceptual model does not include direct paths from the antecedent variables to SDI, the proposed structure represents an indirect-effect model; claims of full mediation should only be made after statistically comparing the indirect effects with corresponding direct effects in an empirical mode.

This research investigates the development of Indonesian SME Digital Intensity (SDI) by testing whether some antecedent factors, owners' attitude toward digital innovation, business complexity, growth orientation, government intervention, and business networking, operate through two internal capabilities namely e-literacy (DL) and Financial Literacy for Perception to Digital Benefit (FLDB). The unit of analysis was

digitalized SMEs in Indonesia. The data were collected from SME owners or operators who have adopted digital technologies by using field surveys. The data were analyzed quantitatively by Structural Equation Modeling (SEM). The analysis was carried out to estimate the indirect effects and to evaluate the significance of the indirect effects using standardized path coefficients and p-values. The findings reveal that owners' attitudes toward digital innovation, growth orientation, and business networking significantly affect the SDI through DL. However, business complexity and government intervention through DL do not significantly affect the SDI. The results show that FLDB, growth orientation, government intervention and business networking significantly increases SDI and business complexity is insignificant. Conceptually, the model positions DL as the ability that enables SMEs to use digital technologies (supporting SDI according to technology-use logic such as perceived usefulness and ease of use), while FLDB reflects the ability to recognize and assess the financial value of digitalization (e.g., efficiency, revenue growth, cost reduction, profitability, and long-term value), making the two mediators complementary mechanisms for digital transformation.

The conceptual framework explicitly specifies an indirect-effect model, where the two mediation pathways (antecedents → DL → SDI and antecedents → FLDB → SDI) are prioritized over the direct paths from antecedents to SDI. However, because these direct paths are not included in the model, the manuscript itself points out that claims of full mediation should be made only after a statistical comparison of the indirect effects with the corresponding direct effects in an empirical model. The analysis can be extended with complementary approaches such as multiple mediation bootstrapping and comparing models with and without mediators using predictive relevance or other appropriate model-comparison criteria to reinforce the evidence that DL and FLDB operate as mediating mechanisms.

The study further examines how these factors support and accelerate digital adoption among SMEs through financial and digital perspectives, particularly digital literacy and financial literacy. With respect to respondent characteristics, the study surveyed 265 SME owners, each representing one enterprise. Most respondents were based on the island of Java, while fewer participants were drawn from other regions, including Sumatra, Kalimantan, Sulawesi, Maluku, Bali, East Nusa Tenggara (NTT), West Nusa Tenggara (NTB), and Papua.

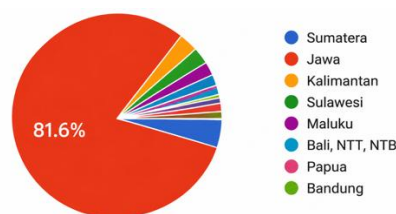


Figure 2. Respondent Location

Based on the categorization of small and medium-sized enterprises (SMEs) by business sector, the findings indicate that nearly half of the respondents operate in the food

and beverage (F&B) industry, representing 48.1% of the total sample. The service sector follows with 11.2%, while businesses in the fashion sector account for 10.4% of the respondents.

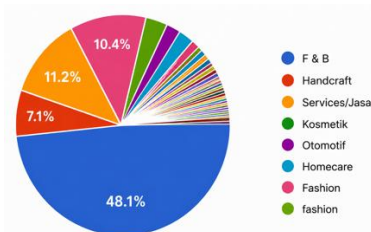


Figure 3. Type of SMEs

The sample consists mainly of SMEs in the food and beverage (F&B) sector (48.1%), followed by service businesses (11.2%), while the fashion industry also represents an important segment of the SME ecosystem. These sectors reflect the diversity of Indonesian SMEs and their growing interest in digital business opportunities. This study, “Bridging Innovation and Digitalization: The Critical Role of Digital and Financial Literacy in Indonesian SMEs,” examines the factors driving digital transformation among Indonesian SMEs. Using a cross-sectional survey and Structural Equation Modeling (SEM), the study analyzes the roles of business complexity, business networking, digital and financial literacy, growth orientation, government intervention, owners’ attitudes toward digital innovation, and SMEs’ digital intensity. The results show that stronger digital and financial literacy, technological capabilities, and business networks encourage greater digital adoption. The findings also reveal that digital investment has increased since the pandemic, although adoption levels vary across industries, providing valuable insights for policymakers and SME owners to support digital transformation.

RESULT AND DISCUSSION

A pilot study was conducted with 30 respondents to evaluate the validity and reliability of the research instruments before the main survey. Participants represented the target population and provided feedback on the clarity of the questionnaire, instructions, and overall structure. The pilot test identified several items that required improvement, including ambiguous questions and unclear instructions. Based on the feedback, the instruments were revised by refining the wording, improving the instructions, and adjusting several variables. The final results showed that the revised instruments achieved satisfactory validity and reliability, making them suitable for the main data collection. Overall, the pilot study strengthened the research design by ensuring that the instruments were clear, consistent, and effective in measuring the intended variables.

The conceptual logic of this study considers the antecedents of OADI, BC, GO, GI and BN as initial conditions that need to be transformed into internal capabilities, especially technological literacy (DL) and Financial Literacy for Digital Business (FLDB) to generate digital value and improve Sustainable Digital Intensity (SDI). DL is linked to higher digital adoption intensity since stronger digital capabilities allow SME owners to better grasp the

utility and ease of use of digital technologies, which is consistent with the reasoning of technology acceptance. Meanwhile, FLDB is positioned as a complementary capability to DL, focusing on not only the ability to use digital technologies but also the capacity to assess the economic value and the business benefits of digitalization. The findings of the study indicate that the model has a strong explanatory power to SDI with $R^2=0.660$. Thus, the predictors and mediating variables in the model account for 66% of the variation in SDI. The sample profile is marked by the predominance of the SME in the food and beverage industry (48.1%), followed by the service sector (11.2%), while the fashion industry also represents an important segment. It also notes that digital investment by SMEs has increased since the pandemic but the extent of digital adoption still varies across industries. To provide stronger evidence that DL and FLDB are indeed functioning as mediating mechanisms and not merely statistically significant associations, the study recommends complementary analyzes such as multiple-mediation bootstrapping and comparisons between models with and without mediators based on predictive relevance or other appropriate criteria. The mediation results should also clearly show the direct, indirect and total effects by reporting bootstrap confidence intervals and testing whether the direct relationships between the antecedents and SDI change after the mediating variables are introduced in the model.

Data Analysis Results and Respondent Profile.

To strengthen the research design, sampling logic, and generalizability of the findings, future research should consider adopting a longitudinal approach to capture changes in SMEs' digital transformation over time and provide stronger evidence of causal relationships. A mixed-methods design combining quantitative surveys with qualitative interviews or case studies could further enrich the findings by capturing contextual factors influencing digital and financial literacy, while the inclusion of comparison groups, such as SMEs that have not yet adopted digital technologies, could provide additional insights into the relationship between literacy and digital transformation. The sampling strategy could also be improved through stratified random sampling to ensure adequate representation across regions, business sectors, firm sizes, and stages of digital adoption, complemented by a larger sample size to increase statistical power and reduce sampling error. Greater inclusion of SMEs from underrepresented regions and sectors, particularly those beyond Java, would enhance the representativeness of the sample. Furthermore, developing a comprehensive sampling frame based on official SME registries and conducting cross-context validation in other emerging economies would strengthen the external validity and broader applicability of the findings. Finally, measures such as ensuring respondent anonymity and providing appropriate incentives could help minimize response and social desirability biases. Collectively, these strategies would provide more rigorous and generalizable evidence regarding how digital and financial literacy shape SME digital transformation and would support the development of more relevant policy and managerial recommendations across diverse contexts.

Data from 265 Indonesian SMEs show that most business owners have adequate digital and financial literacy and are confident in using technologies such as computers,

smartphones, and tablets. Respondents also reported positive attitudes toward digital innovation, recognizing its potential to improve efficiency, productivity, competitiveness, and market opportunities. This reflects a strong willingness among SME owners to adopt new technologies and integrate them into their business strategies to support long-term growth. The measurement model also demonstrated good convergent validity. All constructs met the recommended thresholds, with Cronbach's alpha values above 0.70 and Average Variance Extracted (AVE) values above 0.50, confirming that the research instruments are reliable and valid.

Table 1. Results of Convergent Validity Test

Construct	Cronbach's alpha	Composite reliability (rho_a)	Composite reliability (rho_c)	Average variance extracted (AVE)
BCO	0.805	0.808	0.866	0.568
BNO	0.828	0.842	0.875	0.542
DLO	0.902	0.906	0.922	0.629
FLDBO	0.938	0.939	0.948	0.697
GIO	0.823	0.828	0.872	0.532
GOO	0.829	0.849	0.871	0.532
OADIO	0.908	0.925	0.927	0.645
SDIO	0.926	0.928	0.941	0.694

The measurement model demonstrated strong reliability and validity. All constructs, including Business Complexity, Business Networking, Digital Literacy, Financial Literacy, Digital Benefit, Government Intervention, Growth Orientation, Owners' Attitudes toward Digital Innovation, and SMEs' Digital Intensity, recorded Cronbach's alpha values above 0.70, confirming good internal consistency. In addition, all indicators met the required outer loading criteria, and the Average Variance Extracted (AVE) values exceeded 0.50, indicating satisfactory convergent validity. These results confirm that the measurement instruments are reliable and suitable for further analysis.

Discriminant Validity – Fornell Larcker Criterion.

The Fornell–Larcker test confirmed that all constructs achieved good discriminant validity. This indicates that each variable measures a distinct concept and can be clearly differentiated from the others. As a result, the constructs make unique contributions to the model, providing confidence in the reliability of the findings and the interpretation of relationships among the variables.

Table 2. Discriminant Validity using the Fornell-Larcker Criterion

	BCO	BNO	DLO	FLDBO	GIO	GOO	OADIO	SDIO
BCO	0.754							
BNO	0.638	0.736						
DLO	0.469	0.601	0.793					
FLDBO	0.564	0.671	0.749	0.835				
GIO	0.577	0.671	0.530	0.647	0.730			
GOO	0.579	0.588	0.585	0.567	0.535	0.730		
OADIO	0.299	0.449	0.525	0.386	0.408	0.597	0.803	
SDIO	0.556	0.669	0.751	0.771	0.567	0.498	0.424	0.833

The Fornell-Larcker criterion shows that all variables have strong discriminant validity. The square root of each construct's Average Variance Extracted (AVE) is higher than its correlations with other constructs, confirming that each variable measures a distinct concept. These results indicate that the constructs are unique, independent, and able to explain their own indicators more effectively than other variables in the model.

The current use of Fornell-Larcker criterion indicates acceptable levels of discriminant validity. However, some relatively high correlations exist among the constructs, with some being 0.749 between e-literacy and Financial Literacy for Digital Benefit, 0.771 between FLDB and SME Digital Intensity, and 0.751 between e-literacy and SME Digital Intensity, suggesting overlap. As these constructs are conceptually different (one reflecting technological capability, the other financial evaluative ability), it is important to more rigorously establish their discriminant validity. To address this, authors should report the Heterotrait-Monotrait (HTMT) ratios with bootstrapped confidence intervals as recommended in recent methodological literature. HTMT is considered to be a more sensitive and robust measure of discriminant validity than the Fornell-Larcker, and it is particularly appropriate when the constructs are highly correlated. However, demonstrating that the HTMT ratios are below the commonly used threshold of 0.85 (or 0.90 in some cases) with confidence intervals that exclude 1 will strengthen the evidence that these constructs are empirically and conceptually distinct. This is particularly relevant because digit literacy and FLDB are framed as distinct mediators with different underlying mechanisms (digital capability vs. financial evaluative ability) which forms the core contribution of the manuscript. If their measurement items are highly overlapping, the interpretation of their distinct mediating roles can be compromised. Therefore, reporting HTMT ratios and explicitly discussing the measurement discrimination will enhance the validity of the mediational analysis and indicate that the observed effects are not measurement redundancy artifacts.

Collinearity Statistics (VIF) – Inner Model List

The Variance Inflation Factor (VIF) is used to assess collinearity among predictor constructs in the inner (structural) model. A high VIF indicates that predictor variables are highly correlated, which may make it difficult to accurately estimate the individual effect of each predictor.

Table 3. Collinearity Statistics (VIF) – Inner Model List

	VIF
BCO → DLO	2.030
BCO → FLDBO	1.968
BNO → DLO	2.389
BNO → FLDBO	2.336
DLO → SDIO	2.281
FLDBO → SDIO	2.281
GIO → DLO	2.026
GIO → FLDBO	2.007
G00 → DLO	2.251
G00 → FLDBO	1.759
OADIO → DLO	1.648

The inner model collinearity was assessed using the Variance Inflation Factor (VIF). The results show that all VIF values range from 1.648 to 2.389, which are substantially below the recommended threshold of 3.3. The highest VIF value was observed for BNO → DLO (VIF = 2.389), whereas the lowest value was found for OADIO → DLO (VIF = 1.648). These findings indicate that there is no critical collinearity among the predictor constructs in the structural model. Consequently, multicollinearity does not pose a significant threat to the estimation and interpretation of the structural path coefficients.

Convergent Validity Test

The Construct Reliability and Validity results assess whether the measurement instruments used in the study are reliable and valid. Three reliability indicators are reported: Cronbach's Alpha, Composite Reliability (rho_a), and Composite Reliability (rho_c), while Average Variance Extracted (AVE) is used to assess convergent validity.

Table 4. Convergent Validity Test

	Cronbach's alpha	Composite reliability (rho_a)	Composite reliability (rho_c)	Average variance extracted (AVE)
BCO	0.805	0.808	0.866	0.568
BNO	0.828	0.842	0.875	0.542
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G00	0.829	0.849	0.871	0.532
OADIO	0.908	0.925	0.927	0.645
SDIO	0.926	0.928	0.941	0.694

The reliability and validity of the measurement model were assessed using Cronbach's Alpha, Composite Reliability (rho_A and rho_C), and Average Variance Extracted (AVE). The results indicate that all constructs meet the recommended reliability thresholds, with Cronbach's Alpha values ranging from 0.805 to 0.938, rho_A values ranging from 0.808 to 0.939, and rho_C values ranging from 0.866 to 0.948. These results demonstrate satisfactory internal consistency across all constructs. Furthermore, the AVE values range

from 0.532 to 0.697, exceeding the recommended minimum value of 0.50. This indicates that each construct explains more than half of the variance in its respective indicators. Overall, the findings confirm that the measurement model exhibits satisfactory construct reliability and convergent validity, allowing the study to proceed to the assessment of the structural model.

Path Coefficient.

Path Coefficient Analysis, commonly referred to as Path Analysis, is a statistical method derived from regression analysis that is used to evaluate the relative influence of independent variables on a dependent variable within a model. This technique helps clarify the magnitude of both direct and indirect effects that each variable has on other variables in the analytical framework.

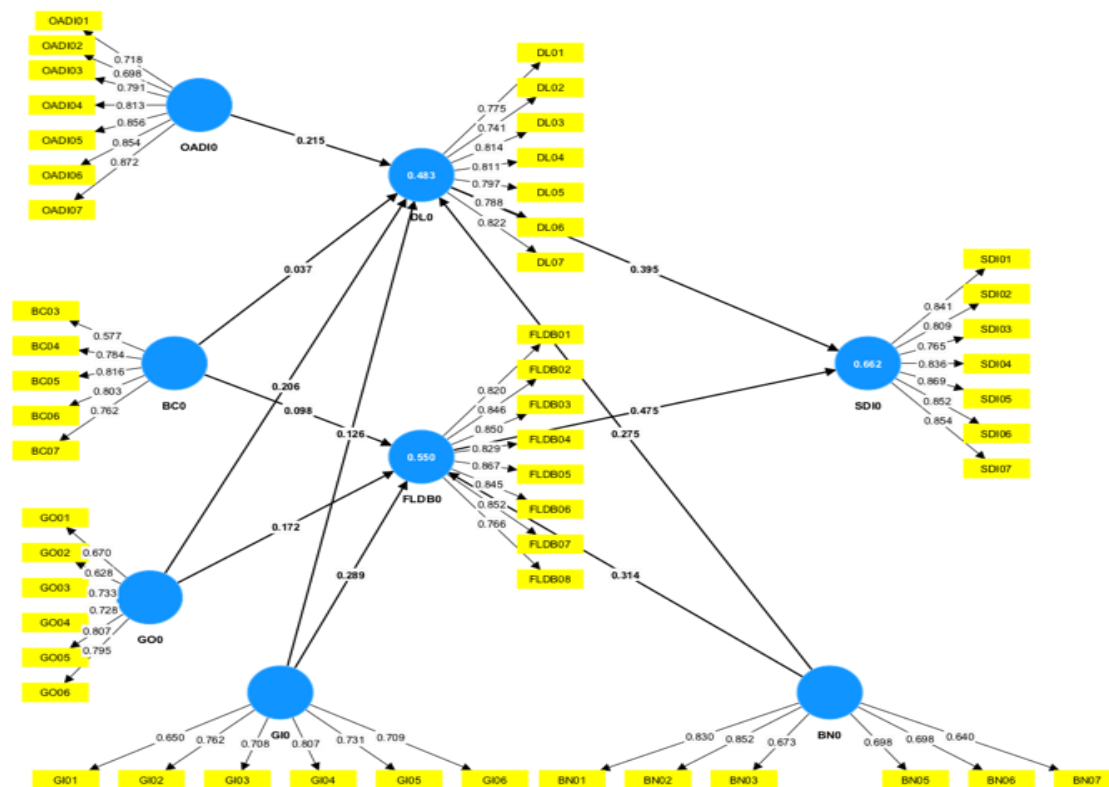


Figure 4. Path Coefficient

The path coefficient analysis produced reliable results for examining the relationships among the study variables. The coefficients indicate the direction and strength of the effects, with higher values representing stronger relationships. The findings confirm that the model is both valid and reliable, and the estimated relationships are consistent with the underlying theory, providing confidence in the study's conclusions.

Hypothesis Test.

Specific indirect effects examine how an independent variable influences a dependent variable through one or more mediating variables, helping explain the underlying mechanisms between constructs. In this study, mediation analysis was conducted using SmartPLS, which is widely used for estimating structural equation models.

Indirect effects were assessed through standardized path coefficients, while statistical significance was determined using p-values. A significant p-value indicates that the indirect effect is statistically meaningful, supporting the proposed mediation relationships.

Table 5. P Values (Indirect Effect)

Path	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics ((O/STDEV))	P values
BCO -> DLO -> SDIO	0.036	0.037	0.038	0.935	0.175
BCO -> FLDBO -> SDIO	0.023	0.027	0.036	0.638	0.262
BNO -> DLO -> SDIO	0.135	0.135	0.051	2.666	0.004
BNO -> FLDBO -> SDIO	0.131	0.132	0.049	2.670	0.004
GIO -> DLO -> SDIO	0.062	0.059	0.042	1.477	0.070
GIO -> FLDBO -> SDIO	0.134	0.134	0.038	3.523	0.000
GOO -> DLO -> SDIO	0.079	0.078	0.038	2.072	0.019
GOO -> FLDBO -> SDIO	0.077	0.077	0.036	2.165	0.015
OADIO -> DLO -> SDIO	0.082	0.084	0.031	2.659	0.004

The mediation analysis shows that digital literacy and financial literacy do not significantly mediate the effects of business complexity or government intervention on SMEs' digital intensity through perceived digital benefits. However, owners' attitudes toward digital innovation, business networking, and growth orientation have significant positive effects on digital intensity. The findings also indicate that digital and financial literacy contribute to stronger perceptions of digital benefits, although their mediating effects vary across the proposed relationships. Overall, the results highlight that SMEs' digital intensity is influenced by multiple interconnected factors rather than a single pathway.

Test Coefficient of Determination (R²).

The coefficient of determination (R²) on the de-pendent variable, namely MSME's Digital Intensity (SDI) is 0.660 or 66% or can be inter-preted as having a strong correlation. This demonstrates that the independent variables used in this study, namely Owner Attitudes toward Digital Innovation (OADI), Business Com-plexity (BC), Growth Orientation (GO), Government Intervention (GI), Business Net-working) and the mediating variables, namely Digital Literacy (DL) and Financial Literacy for Digital Benefit (FLDB), affect the dependent variable, namely MSME's Digital Intensi-ty (SDI) by 66%, while the remaining 34% is influenced by other variables not used in.

Table 6. Coefficient of Determination (R²)

Construct	R-square	R-square adjusted
DLO	0.483	0.473
FLDBO	0.550	0.543
SDIO	0.662	0.660

Source: Author, 2025

Discussion

The findings show that digital literacy plays an important role in strengthening SMEs' digital transformation. Owners who have positive attitudes toward digital innovation and businesses with a strong growth orientation are more likely to increase their digital intensity through higher levels of digital literacy. Likewise, business networking significantly supports digital transformation by providing access to knowledge, digital resources, and strategic partnerships. However, business complexity and government intervention do not have a significant effect on SMEs' digital intensity when digital literacy acts as the mediator. These results suggest that internal readiness, particularly leadership, growth ambition, and collaboration, is more important than organizational complexity or government support alone in encouraging digital adoption.

The study also highlights the importance of financial literacy in supporting digital transformation. Growth orientation, government intervention, and business networking all have significant positive effects on SMEs' digital intensity when mediated by financial literacy. SMEs with better financial knowledge are more capable of evaluating digital investments, managing financial risks, and recognizing the long-term benefits of adopting digital technologies (Kurniasari et al., 2023). In contrast, business complexity does not significantly influence digital intensity through financial literacy, indicating that financial capability is more valuable when combined with strategic business goals and supportive external networks (Sakti et al., 2025).

Overall, the results emphasize that digital and financial literacy are key enablers of SME digitalization, but their impact depends on complementary factors such as positive leadership, business networking, and a growth-oriented mindset. These findings support the Entrepreneurial Value Creation Theory, Technology Acceptance Model (TAM), Social Network Theory, and Cooperation Theory, which highlight the importance of innovation, collaboration, and capability development in driving digital transformation. Therefore, policymakers and SME support institutions should focus on strengthening digital and financial literacy, expanding business networks, and providing targeted programs that help SMEs adopt digital technologies more effectively and improve their long-term competitiveness.

The findings provide important insights into the mechanisms through which SMEs develop digital intensity by highlighting both significant and non-significant pathways. The significant effects of Digital Literacy and Financial Literacy for Perception to Digital Benefit demonstrate that internal capabilities play a central role in translating entrepreneurial conditions and external resources into effective digital engagement. The positive effect of Digital Literacy is consistent with the Technology Acceptance Model (TAM), particularly the role of perceived usefulness and ease of use in facilitating technology adoption, while the significant role of Financial Literacy indicates that the ability to evaluate the financial benefits and returns of digital investments complements technical capabilities and supports more strategic digital adoption. Similarly, the roles of Owner Attitude toward Digital Innovations, Business Networking, and Growth Orientation suggest that entrepreneurial

mindset, access to external knowledge and resources, and growth-oriented behavior are important drivers of digital transformation, both directly and through the development of internal capabilities. In contrast, the non-significant effects associated with Business Complexity and Government Intervention suggest that organizational complexity and external institutional support do not necessarily translate directly into greater digital intensity when SMEs lack sufficient internal readiness, motivation, or capability. Likewise, the absence of mediation in certain pathways indicates that digital and financial literacy alone may not be sufficient to convert external conditions into digitalization outcomes unless these conditions are supported by proactive entrepreneurial attitudes and effective resource mobilization. Theoretically, the findings contribute to the literature by integrating Entrepreneurial Value Creation Theory, TAM, Social Network Theory, and Cooperation Theory to demonstrate how entrepreneurial orientation, relational resources, and internal capabilities interact in shaping SME digital transformation, while particularly emphasizing digital and financial literacy as mechanisms that convert resources and opportunities into digital value. Practically, the results suggest that policymakers, business associations, and SME support institutions should prioritize digital and financial literacy development as a foundation for digital transformation rather than relying solely on external interventions such as government programs or networking opportunities. A more effective SME digitalization ecosystem should therefore combine external support with targeted training, capacity building, financial awareness, and entrepreneurial development, enabling SMEs to better recognize digital opportunities, evaluate their potential value, and translate available resources into sustained digital engagement and greater competitiveness.

CONCLUSION

To enhance the PLS-SEM assessment and strengthen the evidence supporting mediation claims, future analysis should first establish the validity and reliability of the measurement model by confirming convergent validity through factor loadings above 0.70 and AVE above 0.50, discriminant validity using the Fornell-Larcker criterion and HTMT ratio, and internal consistency through Cronbach's alpha and composite reliability above 0.70. The structural model should then be evaluated by reporting SRMR, R^2 for endogenous constructs such as SME's Digital Intensity, f^2 to assess the substantive effects of exogenous variables, and Q^2 to evaluate predictive relevance, while multicollinearity should be examined using VIF values below 5, preferably below 3. To obtain more stable estimates, bootstrapping with at least 5,000 resamples should be applied, with confidence intervals reported for path coefficients and indirect effects. Mediation claims should be supported through formal testing of indirect effects using bootstrap confidence intervals and, where appropriate, additional procedures such as the Sobel test, while alternative models with partial and full mediation can be compared based on explanatory and predictive performance. The analysis should clearly distinguish and report direct, indirect, and total effects, together with their bootstrap confidence intervals, and assess whether the direct relationships between antecedent variables and SME's Digital Intensity change after the mediators are introduced. Finally, complementary analyses, including multiple mediation bootstrapping and comparisons of models with and without mediators using predictive

relevance or appropriate model-comparison criteria, can provide stronger evidence that Digital Literacy and Financial Literacy for Perception to Digital Benefit genuinely function as mediating mechanisms rather than merely showing statistically significant associations. This study highlights the importance of digital and financial literacy in helping SMEs succeed in the digital economy. Digital literacy enables SMEs to adopt new technologies, improve efficiency, respond to market changes, and meet customer needs, while financial literacy supports better investment decisions, resource allocation, and sustainable digital adoption. Together, these capabilities strengthen business growth and long-term competitiveness. The findings also show that owners' attitudes toward digital innovation, growth orientation, and business networking play key roles in increasing SMEs' digital intensity. Based on Entrepreneurial Value Creation Theory, Technology Acceptance Model (TAM), Social Network Theory, and Cooperation Theory, the study emphasizes that digital transformation is driven not only by technology but also by leadership, collaboration, and skills development. Therefore, policymakers should prioritize programs that enhance digital and financial literacy while encouraging networking and collaboration to accelerate the digital transformation of Indonesian SMEs.

Based on the paper, the authors acknowledge that the current mediation model is incomplete, as it does not incorporate direct paths from variables such as Owner Attitude toward Digital Innovation (OADI), Business Complexity, Growth Orientation, Government Intervention, and Business Networking to SME Digital Intensity.

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