Adoption of Digital Technology and Marketing in Enhancing SMEs Business Performance

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Abstract

Purpose: This study examines the effects of technology adoption and digital marketing on the performance of Small and Medium Enterprises (SMEs), with Human Resource (HR) readiness tested as a mediating variable.

Methodology/approach: A quantitative, cross-sectional survey was conducted with 300 SMEs in Kecamatan Manggala, Kota Makassar. Data were analyzed using partial least Squares– Structural Equation Modeling (PLS-SEM), including reliability, validity, and structural diagnostics.

Results: All seven hypotheses were supported. Technology adoption and digital marketing exert positive and significant effects on HR readiness and SME performance. HR readiness has a direct positive impact on performance and mediates the relationships between technology adoption, digital marketing, and business outcomes. The indirect effect through HR readiness is stronger for digital marketing than for technology adoption, underscoring the central role of human capacity in digital transformation.

Conclusions: Strengthening HR readiness is essential for converting digital adoption into higher SME performance. Programs that combine technology deployment with training and change management support are likely to yield greater and more sustainable performance gains for urban SMEs in developing countries.

Limitations: This study is limited to SMEs in one urban district, uses cross-sectional self-reported data, and does not account for wider contextual factors, such as policy, infrastructure, or market conditions.

Contributions: This study shows that HR readiness is a key mechanism through which technology adoption and digital marketing enhance SME performance, based on evidence from urban SMEs in a developing-country context, and highlights the need to align digital initiatives with human resource development to achieve sustainable performance gains.

Keywords: *Business Performance, Digital Marketing, Human Resource Readiness, SMEs, Technology Adoption*

1. Introduction

Over the past decade, digitalization has fundamentally transformed the way Micro, Small, and Medium-Sized Enterprises (MSMEs) design value propositions, reach markets, and manage business processes. Various studies affirm that digitalization drives Business Model Innovation (BMI) through the creation of new value streams and enhanced organizational agility in experimenting with and reconfiguring business activities (Sahut, Dana, & Laroche, 2020; Wirtz & Kubin, 2023). In the small business sector,

BMI acts as a mediator linking digital capabilities to improved performance, as digitalization enables MSMEs to adapt their business models more quickly and efficiently (Mies & Hausberg, 2023; Veiga, Marnoto, Guerra-Mota, & Rexhepi, 2024; Wang, Lin, Chen, Lyulyov, & Pimonenko, 2023). In Indonesia, digital transformation has become increasingly prominent, particularly after the pandemic, when MSMEs were strongly encouraged to utilize technology and digital services supported by training and financing facilities (Fitriasari, 2020; Legowo & Sorongan, 2022).

From a marketing perspective, Social Networking Sites (SNS) have become strategic channels with low costs but wide reach to enhance visibility, customer engagement, and sales conversion. Their impact will be optimal if content strategies are integrated with order fulfillment capabilities and marketing analytics, which requires alignment between digital marketing front-end activities and back-end operations (Bouwman, Nikou, Molina-Castillo, & de Reuver, 2018; Jun et al., 2022). Several practical MSME assistance programs have shown that increasing the capacity to utilize social media can tangibly expand markets and increase demand (Vania & Fikriah, 2023). Thus, digital marketing is not merely a promotional tool but also an indicator of MSMEs' readiness to manage data-driven business processes.

Digital transformation in MSMEs is not merely related to technology adoption but also encompasses the development of organizational capabilities, such as digital skills, process integration, and dynamic capabilities. The role of managerial support is important to ensure that the use of technology can create value and be operationalized consistently (Jun et al., 2022; Wirtz & Kubin, 2023). In this context, Human Resource (HR) readiness becomes a key factor in determining the success of technology implementation, as digital literacy, technical skills, and managerial competencies contribute to minimizing resistance to change and ensuring effective process integration (Mies & Hausberg, 2023; Sahut et al., 2020).

Although many previous studies have highlighted the positive impact of technology adoption and digital marketing on MSME performance, empirical results still show considerable variation, mainly due to differences in organizational capacity and process integration quality (Farina & Opti, 2023; Octiva, Haes, Fajri, Eldo, & Hakim, 2024; Sijabat & Ikhsan, 2024). Various internal limitations of MSMEs, such as limited capital, low digital literacy, and uneven infrastructure, also hinder the optimal utilization of digital technology (Martín-Peña, Sánchez-López, & Díaz-Garrido, 2020; Putri & Putro, 2024). Therefore, HR readiness is a critical element in ensuring that technology and digital marketing can be converted into tangible improvements in business performance.

The context of MSMEs in Makassar City further strengthens the urgency of this research. With the number of MSMEs reaching 5,387 and the Manggala District having the largest concentration, this area is representative for examining the mechanism through which digital adoption at the small business level can affect business performance through HR readiness. This population structure provides an opportunity to understand the conversion of digital adoption into performance outcomes in a dynamic and competitive market environment.

Although the topic of MSME digitalization has been widely studied, two important gaps have not been adequately addressed. First, previous studies generally only assess the direct effects of technology adoption and digital marketing on performance; therefore, the mediating mechanism of HR readiness has not been widely tested simultaneously within a single structural model, especially in the context of urban MSMEs such as Makassar (Ratnani & Al Aksar, 2025; Veiga et al., 2024). Second, there is a lack of quantitative evidence that differentiates between operational and financial outcomes when HR readiness is included as a mediator (Octiva et al., 2024; Sijabat & Ikhsan, 2024). Thus, this study makes an important scientific contribution by integrating technology adoption, digital marketing, and HR readiness into a single empirically tested mediation model, which has not been widely examined in the context of Indonesian MSMEs.

Based on the background and research gaps, this study aims to (1) analyze the effect of technology adoption and digital marketing on HR readiness, (2) examine the effect of technology adoption, digital

marketing, and HR readiness on MSME business performance, and (3) assess the mediating role of HR readiness in the relationship between technology adoption, digital marketing, and MSME performance.

2. Literature Review and Hypothesis Development
1.1. Technology Acceptance Model (TAM) and Diffusion of Innovations (DOI) Theory
The Technology Acceptance Model (TAM) Davis (1989) emphasizes that technology acceptance is influenced by perceived usefulness and perceived ease of use, which shape attitudes and behavioral intentions regarding technology use. Meanwhile, Diffusion of Innovation (DOI) theory Rogers and Adhikarya (1979) emphasizes the process of innovation adoption through the stages of knowledge, persuasion, decision, implementation, and confirmation. Both frameworks are relevant to MSMEs because technology adoption is influenced not only by the technical quality of the system but also by the readiness and maturity of users as agents of organizational change.

In the MSME context, the integration of TAM and DOI theories explains that the value of digitalization can only be realized if business actors have the competency readiness to operate technology and utilize information processing effectively (Ardila, Wibasuri, & Lestari, 2025; Cahyadi, Suryantari, & Murti, 2023; Wirtz & Kubin, 2023). Therefore, this study uses both theories as the basis for the conceptual relationship between technology adoption, digital marketing, human resource readiness, and business performance.

2.2. Hypothesis Development
2.2.1. Effect of Technology Adoption on Human Resource Readiness
Technology adoption requires strengthening human resource competencies through digital literacy, process adjustment, and the implementation of technology-based work practices. MSME training and assistance have been proven to increase business actors' readiness to operate financial applications, record systems, or other digital platforms (Mies & Hausberg, 2023; Wulandari & Paramitalaksmi, 2024).

H_1: Technology adoption has a positive and significant effect on HR readiness.

2.2.2. Effect of Digital Marketing on Human Resource Readiness
Digital marketing requires the ability to manage content, analyze algorithms, and interpret customer data. HR readiness increases when MSME actors participate in digital marketing training and social media–based practices (Bouwman et al., 2018; Jun et al., 2022).

H_2: Digital marketing has a positive and significant effect on HR readiness.

2.2.3. Effect of Technology Adoption on Business Performance
Technology improves efficiency, accuracy, and service speed. Digitalization enables MSMEs to reduce operational costs and improve service quality, thereby strengthening their business performance (Sahut et al., 2020; Veiga et al., 2024).

H_3: Technology adoption has a positive and significant effect on business performance.

2.2.4. Effect of Digital Marketing on Business Performance
Digital marketing activities expand market reach, increase customer interaction, and build consistent brand positioning, thereby supporting improvements in commercial performance (Laurina, Swastuti, Nurchayati, & Yunita, 2024; Wirtz & Kubin, 2023).

H_4: Digital marketing has a positive and significant effect on business performance.

2.2.5. Effect of Human Resource Readiness on Business Performance
Human resource readiness (digital literacy, technical skills, and managerial capabilities) enables technology and digital marketing to be implemented optimally, thereby impacting productivity and business growth (Farhan, Eryanto, & Saptono, 2022; Harahap, 2025).

H_5: HR readiness positively and significantly affects business performance.

2.2.6. Mediating Role of Human Resource Readiness in the Effect of Technology Adoption on Business Performance

Technology does not automatically improve performance without adequate HR readiness. Skilled business actors can operate digital applications and integrate them into business governance, thereby strengthening the impact of technology on performance (Mies & Hausberg, 2023). The results of the SEM-PLS analysis suggest that the mediation is partial.

> *H6:* Technology adoption positively and significantly affects business performance through HR readiness.

2.2.7. Mediating Role of Human Resource Readiness in the Effect of Digital Marketing on Business Performance

The success of digital marketing depends on HR capabilities in managing content, understanding algorithms, and applying data insights to marketing strategies. These competencies have been proven to be an important bridge for improving sales performance (Jun et al., 2022; Vania & Fikriah, 2023). The mediation was also partial, according to the PLS results.

> *H7:* Digital marketing positively and significantly affects business performance through HR readiness.
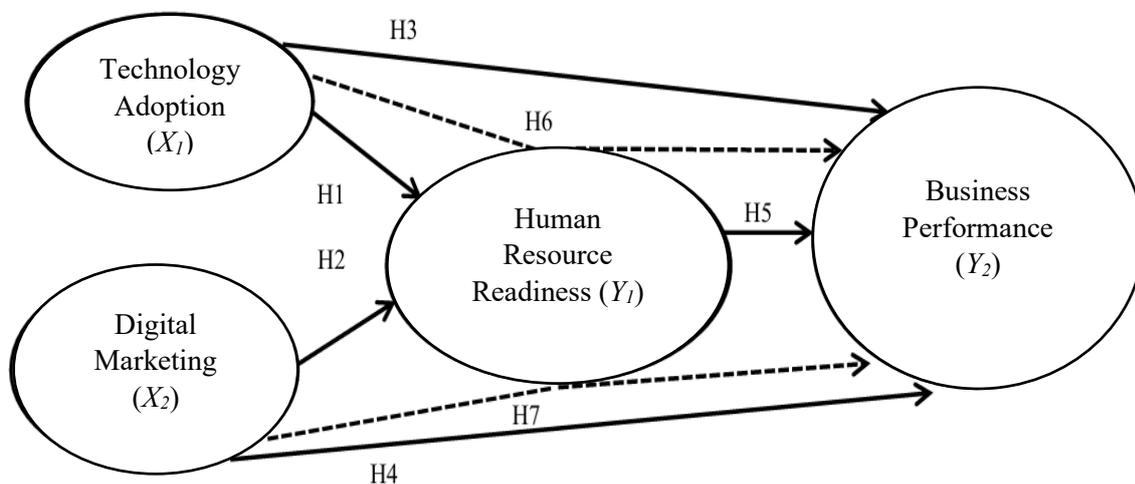

Figure 1. Research conceptual framework

Figure 1 shows the conceptual relationship between technology adoption (X_1), digital marketing (X_2), human resource readiness (Y_1), and business performance (Y_2). This model illustrates that technology adoption and digital marketing not only have direct effects on business performance but also indirect effects through HR readiness as a mediator. Hypotheses H_1 and H_2 describe how both exogenous variables shape HR readiness, whereas H_3, H_3, and H_5 show the direct relationships between each variable and business performance. In addition, H_6 and H_7 emphasize the mediating role of HR readiness in strengthening the mechanism of converting digitalization into improved business performance. Overall, this conceptual framework summarizes the theoretical and empirical relationships that form the basis for formulating the research hypotheses.

3. Research Methodology
3.1. Research Design

This study used a quantitative method with a survey technique using questionnaires to obtain primary data from MSME actors. The research location was determined to be the Manggala District in Makassar City, which has a relatively high concentration of MSMEs. Sampling was conducted using the Slovin formula with a margin of error of 5% from a total population of 1,199 MSME units, resulting in 300 MSME actors as respondents. The data analysis technique used was Partial Least Squares (PLS-SEM) through the SmartPLS software (version 4.1.0.6), as it is capable of analyzing both direct and indirect relationships among research variables.

Table 1. Number of MSMEs in Makassar City by district

No	District	Number (Units)
1	Wajo	160
2	Ujung Tanah	207
3	Ujung Pandang	415
4	Tamalate	668
5	Tamalanrea	150
6	Tallo	429
7	Rappocini	551
8	Panakkukang	355
9	Mariso	242
10	**Manggala**	**1.199**
11	Mamajang	305
12	Makassar	256
13	Kepulauan Sangkarrang	86
14	Bontoala	139
15	Biringkanaya	225
Total		**5.387**

The research model tested in the SEM-PLS follows the structure of the relationships among variables, as shown in Figure 1. Hypothesis testing was conducted using the bootstrapping procedure with 5,000 subsamples to ensure the stability of the parameter estimates (Hair Jr et al., 2021).

3.2. Sampling Technique
Sampling was conducted on MSME actors who met the research criteria, namely, being located in the Manggala District, Makassar City; having an established business that had been operating for at least one year; using technology in operations or marketing; and having a workforce of between 1 and 100 employees, covering micro, small, and medium enterprise categories. With these criteria, the selected sample is expected to be representative in explaining the phenomena studied.

3.3. Data Collection Technique
Data were collected in two ways. First, questionnaires were distributed via Google Forms to facilitate respondents who are accustomed to using digital technology. Second, questionnaires were distributed directly by visiting MSME business locations in the Manggala District. The research instrument included questions related to digital technology adoption, digital marketing, human resource readiness, and business performance. All statement items were measured using a five-point Likert scale, ranging from strongly disagree (1) to strongly agree (5), to facilitate the data quantification process in the structural equation model–partial least squares analysis.

All data collection activities were conducted in accordance with research ethics. The respondents were provided with an explanation regarding the research objectives, confidentiality of information, and the voluntary nature of participation. Informed consent was obtained before completing the questionnaire, and no personal identity information was collected during the study.

3.4. Operational Definition of Variables
Research variables are the characteristics or attributes selected and measured by the researcher to answer the research questions. The operational definition of variables serves as a clear and specific guideline for how these variables are measured in this study. The variables used consist of two independent variables (X_1 and X_2), one dependent variable (Y), and one mediating variable (M).

Table 2. Operational variables

Variables	Operational Definition	Indicators	Sources
Technology Adoption (X_1)	Technology adoption is the process by which MSME actors accept and utilize technological innovations to improve efficiency, effectiveness, and business competitiveness.	1. Knowledge 2. Persuasion 3. Decision 4. Implementation 5. Confirmation	(Sahut et al., 2020; Veiga et al., 2024)
Digital Marketing (X_2)	Digital marketing is a strategy for marketing products or services through digital media by utilizing the Internet and online platforms to expand markets.	1. Perceived usefulness 2. Perceived ease of use 3. Behavioral intention to use 4. Actual system usage	(Bouwman et al., 2018; Jun et al., 2022)
Human Resource Readiness (M)	Human resource readiness refers to the ability, knowledge, and attitudes of MSME actors in accepting and implementing technology-based changes.	1. Appropriateness 2. Management support 3. Change efficacy 4. Personal valence	(Farhan et al., 2022; Harahap, 2025)
Business Performance (Y)	Business performance is the achievement outcome of MSMEs, including productivity, innovation, and the attainment of sustainable economic value.	1. Success in launching new products 2. Waste reduction 3. Increased market opportunities 4. Product innovation 5. Improvement of work methods 6. Quality improvement	(Laurina et al., 2024; Wirtz & Kubin, 2023)

4. Results and Discussion

4.1. Analysis Results

4.1.1 Outer Model Test Results

Figure 2 presents the output of the PLS algorithm in two estimation stages. In Algorithm I, three indicators were found to have loading factors < 0.70 (AT5, DM1, DM4); therefore, they did not meet the convergent validity criteria. In accordance with the PLS-SEM procedure, these three indicators were eliminated, and the model was re-estimated (Figure 3, Algorithm II) so that only indicators that truly reflect the constructs were retained.
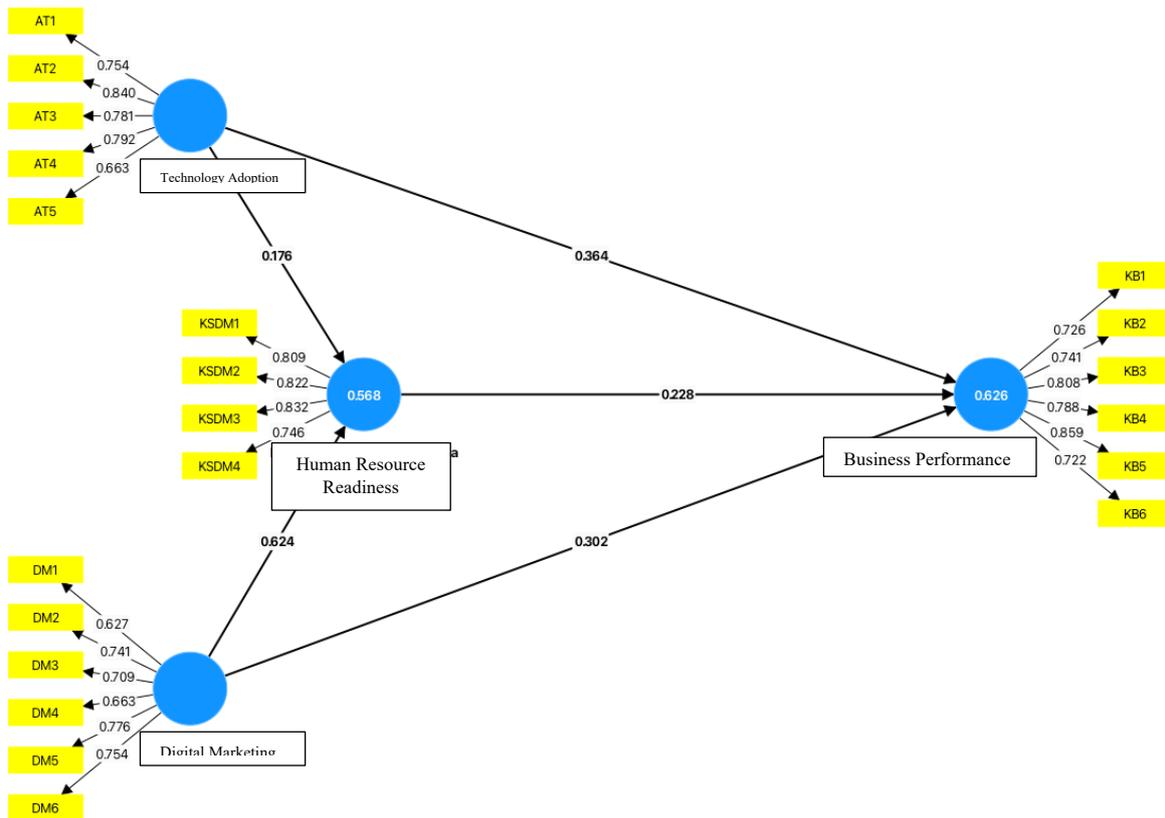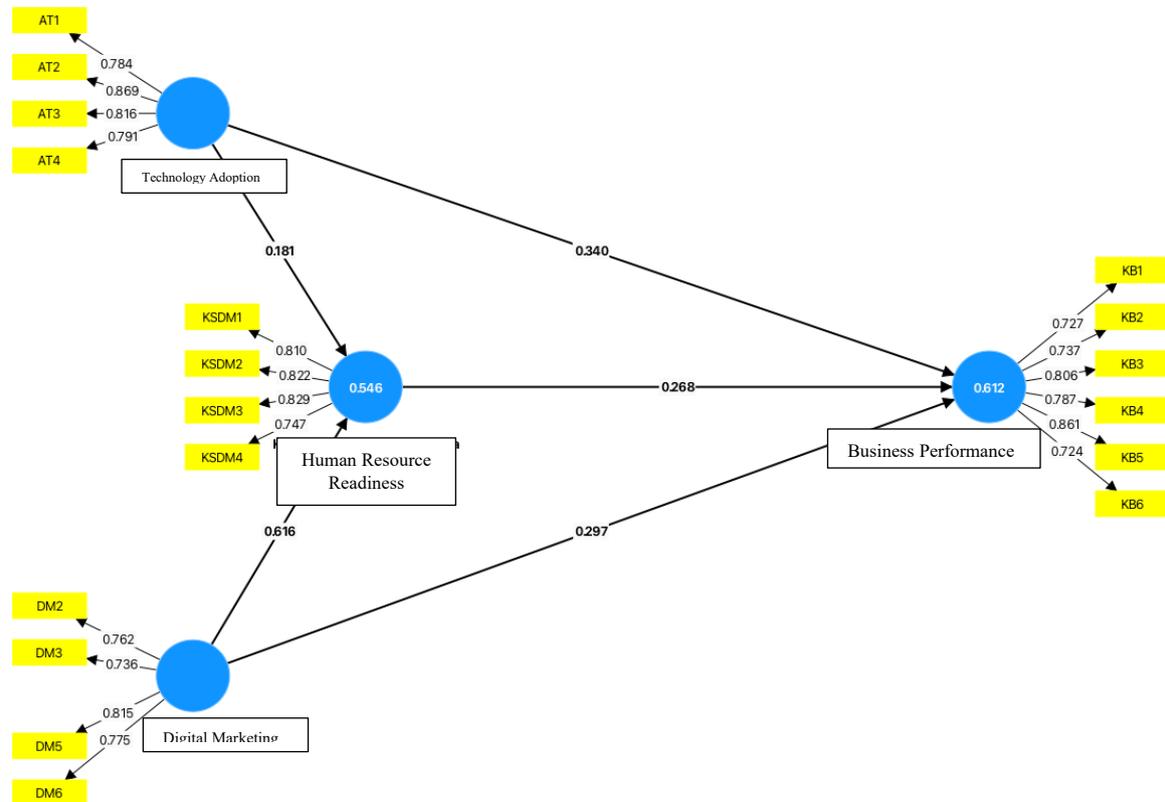
Figure 2. PLS Algorithm I

Figure 3. PLS Algorithm II

Table 3 presents the outer loading values in Algorithm II after the problematic indicators were removed. All remaining indicators had loading values above 0.70, indicating that each indicator could adequately reflect its construct. Thus, it can be confirmed that convergent validity was achieved across all

constructs after indicator purification; therefore, the measurement model was ready to proceed to the reliability and discriminant validity testing stages (Table 3).

Table 3. Indicator loading factor values (Algorithm II)

Indicator	Technology Adoption	Digital Marketing	HR Readiness	Business Performance
AT1	0,784			
AT2	0,869			
AT3	0,816			
AT4	0,791			
DM2		0,762		
DM3		0,736		
DM5		0,815		
DM6		0,775		
KSDM1			0,810	
KSDM2			0,822	
KSDM3			0,829	
KSDM4			0,747	
KB1				0,727
KB2				0,737
KB3				0,806
KB4				0,787
KB5				0,861
KB6				0,724

4.1.2. Composite Reliability (CR) Values

Before assessing discriminant validity, the internal reliability of each construct was tested using Composite Reliability (CR). High CR values indicate consistency among indicators in measuring the same construct. All CR values were > 0.70; therefore, all four constructs are reliable. This means that the indicators within each latent variable are consistent and suitable for further analysis (Table 4).

Table 4. Composite reliability

Variable	Composite Reliability	Description
Technology Adoption (X_1)	0,888	Reliable
Digital Marketing (X_2)	0,855	Reliable
HR Readiness (Y_1)	0,879	Reliable
Business Performance (Y_2)	0,900	Reliable

4.1.3 Average Variance Extracted (AVE) Values

The AVE test was conducted to ensure that the proportion of indicator variance explained by the construct is greater than the measurement error. An AVE value greater than 0.50 is required for good convergent validity. As all AVE values exceeded 0.50, convergent validity was further confirmed. In other words, the indicators in each construct could capture a substantial proportion of the variance of their respective constructs.

Table 5. Average Variance Extracted (AVE)

Variable	AVE	Description
Technology Adoption (X_1)	0,665	Valid
Digital Marketing (X_2)	0,597	Valid
HR Readiness (Y_1)	0,645	Valid

4.1.4. Discriminant Validity

Discriminant validity ensures that different constructs are empirically distinct. The evaluation was conducted using three approaches: cross-loading, the Fornell–Larcker criterion, and the HTMT ratio.

4.1.4.1. Cross Loading

Table 6 shows that each indicator loads the highest on its own construct (marked in bold), which is higher than its loadings on other constructs. This is a strong indication that discriminant validity was fulfilled at the indicator level.

Table 6. Cross Loading between Indicators and Constructs

Indicator	AT	DM	KSDM	KB
AT1	**0,784**	0,454	0,472	0,521
AT2	**0,869**	0,506	0,429	0,555
AT3	**0,816**	0,468	0,399	0,529
AT4	**0,791**	0,525	0,489	0,562
DM2	0,571	**0,762**	0,455	0,557
DM3	0,525	**0,736**	0,472	0,575
DM5	0,319	**0,815**	0,643	0,527
DM6	0,465	**0,775**	0,648	0,498
KSDM1	0,409	0,686	**0,810**	0,512
KSDM2	0,470	0,625	**0,822**	0,605
KSDM3	0,430	0,552	**0,829**	0,526
KSDM4	0,465	0,439	**0,747**	0,504
KB1	0,528	0,510	0,559	**0,727**
KB2	0,469	0,423	0,481	**0,737**
KB3	0,543	0,549	0,548	**0,806**
KB4	0,455	0,596	0,523	**0,787**
KB5	0,597	0,635	0,553	**0,861**
KB6	0,493	0,498	0,445	**0,724**

4.1.4.2. Fornell–Larcker Criterion

As shown in Table 7, the diagonal values (square roots of the AVE) are greater than the correlations with other constructs in the same row/column. This indicates adequate separation among the constructs at the latent level.

Table 7. Fornell–Larcker Criterion

Variable	AT	DM	KSDM	KB
Technology Adoption (AT)	**0,816**			
Digital Marketing (DM)	0,601	**0,772**		
HR Readiness (KSDM)	0,551	0,724	**0,803**	
Business Performance (KB)	0,666	0,695	0,670	**0,775**

4.1.4.3. Heterotrait–Monotrait (HTMT)

All HTMT values in Table 8 are below 0.90, further strengthening the conclusion that discriminant validity is strictly satisfied.

Table 8. Heterotrait–Monotrait Ratio (HTMT)

Construct Pair	HTMT
AT – DM	0,756
AT – KSDM	0,668
AT – KB	0,781
DM – KSDM	0,893
DM – KB	0,847
KSDM – KB	0,794

Overall, the combination of cross-loading, Fornell–Larcker, and HTMT tests consistently indicates good construct separation, which is an essential prerequisite for evaluating the structural model.

4.1.5. Structural Model Evaluation (Inner Model)
4.1.5.1. R-Square Test Results

The goodness of fit of the structural model was first evaluated using the coefficient of determination (R^2) for endogenous constructs. Higher R^2 values indicate better predictive ability of exogenous variables on endogenous variables.

Table 9. R-Square values

Endogenous Construct	R^2	Adjusted R^2
HR Readiness (Y_1)	0,546	0,543
Business Performance (Y_2)	0,612	0,609

Table 9 shows the R^2 value of 0.546 for HR readiness (moderate) indicates that technology adoption and digital marketing explain 54.6% of the variance in readiness. Meanwhile, an R^2 value of 0.612 for business performance (approaching strong) indicates that technology adoption, digital marketing, and HR readiness together explain 61.2% of the variance in performance.

4.1.5.2. Q-Square Test Results (Predictive Relevance)

Predictive relevance was evaluated using the blindfolding procedure to obtain Q^2 values. A Q^2 value greater than 0 indicates that the model has adequate predictive capability for the observed data. With Q^2 (Y_1) = 0.341 and Q^2 (Y_2) = 0.362 (>0), the model proved to have good predictive relevance for both endogenous constructs.

Table 10. Q-Square Values (Blindfolding)

Construct	SSO	SSE	Q^2 (=1–SSE/SSO)
X_1	1364,000	1364,000	
X_2	1364,000	1364,000	
Y_1	1364,000	898,238	0,341
Y_2	2046,000	1304,629	0,362

4.1.6. Hypothesis Testing

Path analysis using bootstrapping (α = 5%) is presented in Table 11. Hypothesis decisions are based on T-values (>1.96) and p-values (<0.05).

Table 11. Summary of Path Coefficients, T-Statistics, and P-Values

Relationship	O	STDEV	T	P	Decision
$X_1 \rightarrow Y_1$ (H_1)	0,181	0,049	3,681	0,000	Accepted
$X_2 \rightarrow Y_1$ (H_2)	0,616	0,049	12,683	0,000	Accepted
$X_1 \rightarrow Y_2$ (H_3)	0,340	0,043	7,928	0,000	Accepted
$X_2 \rightarrow Y_2$ (H_4)	0,297	0,049	6,118	0,000	Accepted
$Y_1 \rightarrow Y_2$ (H_5)	0,268	0,039	6,867	0,000	Accepted
$X_1 \rightarrow Y_1 \rightarrow Y_2$ (H_6)	0,049	0,014	3,468	0,001	Accepted
$X_2 \rightarrow Y_1 \rightarrow Y_2$ (H_7)	0,165	0,029	5,725	0,000	Accepted

Based on the magnitude of the coefficients, the effect of digital marketing on HR readiness was the strongest, followed by the direct effect of technology adoption on business performance and the effect of digital marketing on business performance. In addition, HR readiness was proven to be a significant mediating mechanism for the effects of both technology adoption and digital marketing on business performance. These findings underline that improving digital capabilities must be accompanied by strengthening MSMEs' readiness to maximize performance impacts.

Table 12. Ranking of Effect Magnitudes

Variable Relationship	Path Coefficient
Digital Marketing → HR Readiness	0,616
Technology Adoption → Business Performance	0,340
Digital Marketing → Business Performance	0,297
HR Readiness → Business Performance	0,268
Digital Marketing → Business Performance (through HR Readiness)	0,165
Technology Adoption → Business Performance (through HR Readiness)	0,049
Technology Adoption → HR Readiness	0,181

Based on the bootstrapping results, the hypothesis testing outcomes can be explained as follows:
1. H_1. The results show a coefficient value of 0.181, a t-statistic of 3.681, and a p-value of 0.000. Since t > 1.96 and p < 0.05, Hypothesis 1 is accepted. This means that technology adoption has a positive and significant effect on human resource readiness.
2. H_2. Digital marketing (X_2) on HR readiness (Y_1) shows a coefficient value of 0.616, a t-statistic of 12.683, and a p-value of 0.000. As the significance criteria were met, Hypothesis 2 was accepted. This confirms that digital marketing has a stronger influence on HR readiness than other variables.
3. H_3. Technology adoption (X_1) on business performance (Y_2) has a coefficient value of 0.340, a t-statistic of 7.928, and a p-value of 0.000. Thus, Hypothesis H3a is supported, indicating that technology adoption directly improves MSME business performance.
4. H_4. Digital Marketing (X_2) on Business Performance (Y_2) has a coefficient value of 0.297, a t-statistic of 6.118, and a p-value of 0.000. The hypothesis is accepted. Digital marketing plays an important role in driving business performance, although its effect is smaller than that of technology adoption.
5. H_5. HR readiness (Y_1) on business performance (Y_2) shows a coefficient value of 0.268, a t-statistic of 6.867, and a p-value of 0.000. The hypothesis is accepted, indicating that HR readiness positively and significantly contributes to business performance.
6. H_6. Technology adoption (X_1) on business performance (Y_2) through HR readiness (Y_1) has a mediation coefficient of 0.049 with a t-statistic of 3.468 and a p-value of 0.001. Since the result is significant, H_6 is accepted. Thus, HR readiness acts as a partial mediator that strengthens the effect of technology adoption on business performance.
7. H_7. Digital marketing (X_2) on business performance (Y_2) through HR readiness (Y_1) has a coefficient value of 0.165, a t-statistic of 5.725, and a p-value of 0.000. Hypothesis H_7 is supported. This finding shows that HR readiness is an important mediator in bridging the effect of digital marketing on MSME business performance.

4.2. Discussion
This discussion integrates the statistical findings of the SEM-PLS analysis with the theoretical framework explained in the previous section. The results of the measurement model and structural model indicate that all indicators are valid and reliable, and that all relationship paths are statistically significant. To provide a more concise and structured overview, the R^2, Q^2, and path coefficients for each hypothesis are summarized in the following table.

Table 13. Statistical Summary (R^2, Q^2, β, p-value)

Construct / Hypothesis Path	Statistical Value	Description
R^2 Human Resource Readiness (Y_1)	**0.546**	Moderate
R^2 Business Performance (Y_2)	**0.612**	Strong
Q^2 Human Resource Readiness (Y_1)	**0.341**	Has predictive relevance
Q^2 Business Performance (Y_2)	**0.362**	Has predictive relevance
H_1: $X_1 \rightarrow Y_1$	β = 0.181; p = 0.000	Significant
H_2: $X_2 \rightarrow Y_1$	β = 0.616; p = 0.000	Significant
H_3: $X_1 \rightarrow Y_2$	β = 0.340; p = 0.000	Significant
H_4: $X_2 \rightarrow Y_2$	β = 0.297; p = 0.000	Significant
H_5: $Y_1 \rightarrow Y_2$	β = 0.268; p = 0.000	Significant
H_6 (Mediation $X_1 \rightarrow Y_1 \rightarrow Y_2$)	β = 0.049; p = 0.001	Partial mediation
H_7 (Mediation $X_2 \rightarrow Y_1 \rightarrow Y_2$)	β = 0.165; p = 0.000	Partial mediation

To clarify the mediation mechanisms in relationships H_6 and H_7, the following diagram is included as a visualization of the indirect paths that affect business performance (Figure 4). These results strengthen the theoretical argument that human resource readiness plays an important role in ensuring that digital adoption is effectively converted into improved business performance. Although technology adoption (H_3) and digital marketing (H_4) have direct effects on business performance, the presence of human resource readiness amplifies these effects, as reflected in the significant indirect effect values for H_6 and H_7.

In addition, high R^2 and Q^2 values indicate that the model has strong explanatory power and good predictive relevance. Thus, the model developed in this study is empirically capable of explaining the mechanism by which MSME digitalization is converted into improved business performance through human resource readiness as a mediating variable.
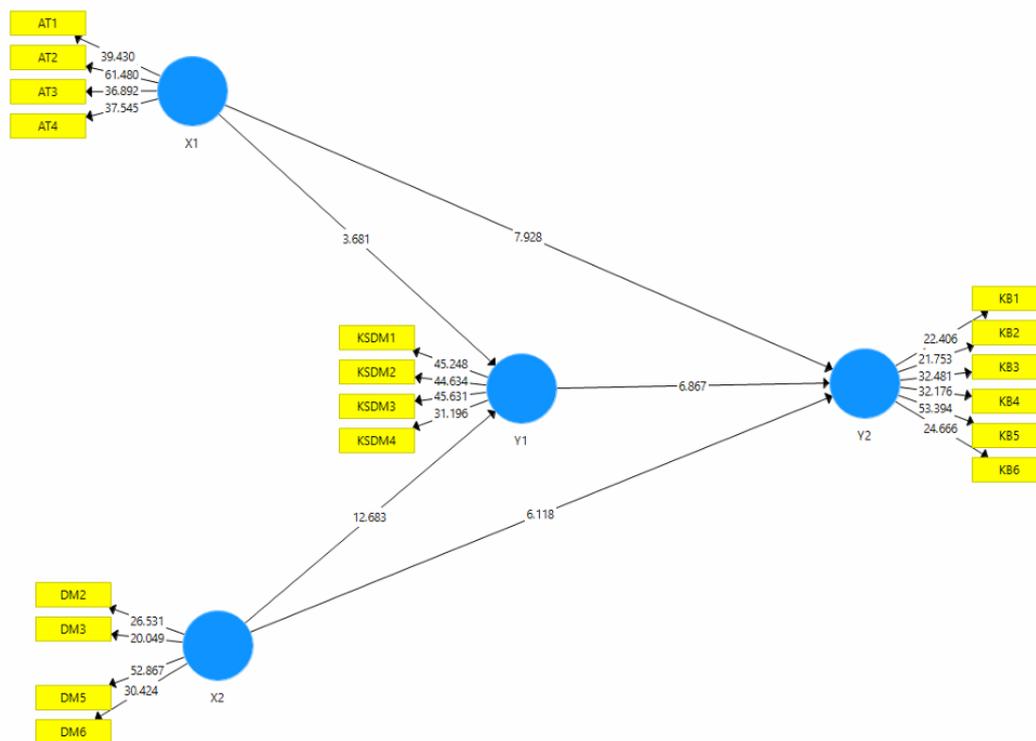

Figure 4. Human resource readiness mediation model

4.2.1. Technology Adoption and Human Resource Readiness

The test results show that technology adoption has a positive effect on human resource readiness (β = 0.181; $p \leq 0.05$). This finding confirms that the use of technology encourages practice-based learning, strengthens digital literacy, and shapes new work patterns among MSMEs in the Manggala District. Theoretically, digitalization enhances organizational capabilities through process reengineering and activity standardization (Sahut et al., 2020; Wirtz & Kubin, 2023). Previous studies indicate that technology adoption acts as a trigger for the formation of digital capabilities that underlie human resource readiness to accept and internalize new practices (Mies & Hausberg, 2023; Veiga et al., 2024). This is consistent with the principles of TAM and DOI, which emphasize that perceived usefulness and ease of use accelerate the internalization of competencies. Thus, technology adoption serves as an initial foundation for building human resource readiness in MSMEs.

4.2.2. Digital Marketing and Human Resource Readiness

Digital marketing also positively affects human resource readiness (β = 0.616; $p \leq 0.05$). Activities such as content creation, customer interaction management, and marketing metrics analysis enhance digital skills and analytical discipline within teams. This aligns with the findings of Bouwman et al. (2018)

and Wirtz and Kubin (2023), who emphasize that managing digital channels creates repetitive learning processes and expands data-driven marketing competencies. Previous studies have also demonstrated that digital marketing training significantly improves team coordination and technical capacity (Veiga et al., 2024). The findings of this study reinforce the evidence that strengthening digital competencies forms the foundation of human resource readiness to implement marketing campaigns and adaptively respond to customer dynamics.

4.2.3. Technology Adoption and Business Performance

Technology adoption improves business performance ($\beta = 0.340$; $p \leq 0.05$). Digital technology enables MSMEs to accelerate information flows, reduce operational errors, and improve process efficiency, thereby affecting productivity and service quality (Elvira et al., 2025; Sahut et al., 2020). The literature also positions digitalization as a driver of business model innovation and improved operational performance (Veiga et al., 2024). In the context of this study, the use of simple applications for inventory, ordering, and payment directly reduces coordination costs and improves service smoothness. Thus, technology adoption is a key driver of improved MSME performance.

4.2.4. Digital Marketing and Business Performance

Digital marketing positively affects business performance ($\beta = 0.297$; $p \leq 0.05$). Digital channels help MSMEs expand markets, increase customer engagement, and obtain rapid feedback for improving value propositions (Bouwman et al., 2018; Elvira et al., 2025). When promotional strategies are integrated with order fulfillment processes, commercial impacts increase significantly (Aryando et al., 2024; Jun et al., 2022; Sari & Gultom, 2019). Previous studies have also noted increases in orders and revenue following digital training interventions (Laurina et al., 2024). In this study, the success of converting digital traffic into sales is influenced by operational readiness and consistency in brand communication. Therefore, professionally managed digital marketing is proven to be effective in improving small business performance.

4.2.5. Human Resource Readiness and Business Performance

Human resource readiness also positively affects business performance ($\beta = 0.268$; $p \leq 0.05$). Digital competencies, technical skills, and managerial capabilities are prerequisites for new technologies to generate added value (Wirtz & Kubin, 2023). Human resource readiness also positively affects business performance ($\beta = 0.268$; $p \leq 0.05$). Digital competencies, technical skills, and managerial capabilities are prerequisites for new technologies to generate added value (Gunawan, Wirjawan, & Soer, 2023). Continuous training and mentoring programs in Indonesia have positive impacts on the sustainability of technology use and improvements in performance indicators (Cahyadi et al., 2023). In the context of this study, human resource readiness supports daily process adaptation so that operational efficiency can be converted into more stable commercial performance.

4.2.6. Mediation of Human Resource Readiness in the Relationship between Technology Adoption and Business Performance

Human resource readiness significantly mediates the relationship between technology adoption and business performance (indirect $\beta = 0.049$; $p \leq 0.05$). Although the mediating contribution is relatively small, this result indicates that learning and experience in technology use enhance organizational capacity to extract value from digital systems (Mies & Hausberg, 2023; Oktaria, Raras, Alam, Barusman, & Habiburrahman, 2024). However, the direct path from technology adoption to performance remains strong, indicating that some benefits of technology emerge immediately after implementation. Therefore, training and technical coaching are important strategies for strengthening the contribution of the mediating path.

4.2.7. Mediation of Human Resource Readiness in the Relationship between Digital Marketing and Business Performance

Human resource readiness mediates the relationship between digital marketing and business performance more strongly than technology adoption (indirect $\beta = 0.165$; $p \leq 0.05$). This mechanism arises because digital marketing relies heavily on human skills in designing content, managing customer interactions, understanding algorithms, and transforming analytics into improvement strategies (Oktaria

et al., 2024; Wirtz & Kubin, 2023). The literature also emphasizes that these competencies serve as the main link between digital exposure and sales conversion (Veiga et al., 2024). The findings of this study show that investments in digital marketing training yield tangible benefits in the form of consistent improvements in MSME commercial performance.

5. Conclusions

5.1. Conclusion
This study demonstrates that technology adoption and digital marketing positively influence MSME business performance, both directly and indirectly through human resource readiness as a partial mediator. The findings highlight that human resource readiness plays an important role in bridging digital transformation and MSME performance outcomes. This indicates that digitalization does not depend solely on the availability of technology but also on the ability of human resources to effectively utilize it. The results emphasize the importance of integrating technology adoption initiatives with structured human capacity development to ensure that digital transformation contributes to sustainable improvements in MSME performance.

5.2. Research Limitations
This study has several limitations that should be considered. First, the research focuses only on MSMEs located in the Manggala District, which may limit the generalizability of the findings to other regions or industries. Second, the use of Likert-scale questionnaires may introduce subjective bias in respondents' answers. Third, the study only examines a limited number of variables, namely technology adoption, digital marketing, human resource readiness, and business performance, without considering other external factors such as government support, market conditions, or socioeconomic influences.

5.3. Suggestions and Directions for Future Research
Future research is recommended to expand the scope of study by including MSMEs from different regions and sectors to obtain more generalizable results. Researchers are also encouraged to incorporate additional variables such as access to financing, government policies, organizational culture, and market dynamics to provide a more comprehensive understanding of MSME digitalization. In addition, future studies may apply mixed-method approaches to gain deeper insights into the role of human resource readiness in supporting digital transformation and business performance improvement.

Author Contributions
AM Conceptualization, research design, data collection, data analysis, manuscript drafting, and final approval. AJ Supervision, methodological guidance, manuscript revision, and final approval.

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