

Analysis of Digital Transformation and Economic Resilience of MSMEs in Ambon City

Sherly Ferdinandus¹, Andre Sapthu², Ventje J Kuhuparuw³, Amin⁴, William G.M. Louhenapessy⁵

^{1,2,4}Faculty of Economics and Business, Pattimura University

³Ambon State Polytechnic

⁵FKIP Pattimura University

Email: sherlyferdinandus75@gmail.com

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Abstract

This study analyzes the influence of digital transformation on the economic resilience of Micro, Small, and Medium Enterprises (MSMEs) in Ambon City. Digital transformation is measured through four variables, namely Operational Digitalization, Digital Literacy, Digital Payments, and Digital Marketing. The study used an explanatory quantitative approach with a cross-sectional survey design. Data was obtained from 190 MSME owners or managers and analyzed using Partial Least Squares-Structural Equation Modeling (PLS-SEM) through the SmartPLS application. The results of the evaluation of the measurement model showed that all indicators met the convergent validity and reliability of the construct. The validity of the discriminant based on the Fornell-Larcker criteria and cross loadings was also met. However, the HTMT value between Digital Payments and Digital Marketing of 0.911 indicates a potential empirical overlap between the two constructs. An R² value of 0.650 indicates that the four independent variables are able to explain 65 percent of the variation in MSME Economic Resilience. Operational Digitalization has a positive and significant effect on the Economic Resilience of MSMEs with a coefficient of 0.492, while Digital Literacy has a positive and significant effect with a coefficient of 0.287. In contrast, Digital Payments and Digital Marketing have a positive, but not significant, direction of influence. These findings confirm that digital application ownership alone is not enough without adequate integration, competencies, strategies, and sustainable business management. The research concludes that the economic resilience of MSMEs is more determined by the integration of technology in operational activities and the ability of business actors to utilize technology appropriately.

INTRODUCTION

Micro, Small, and Medium Enterprises (MSMEs) are the backbone of the regional economy that has a strategic role in job creation (Salsabillah et al., 2023), income distribution, and strengthening the local economy. In Ambon City, MSMEs are spread across various sectors such as culinary, retail trade, services, and creative industries that support the dynamics of the urban economy. The development of digital technology in the past decade has fundamentally changed the business landscape, including the way MSMEs market products, manage transactions, and reach customers. Digital transformation is no longer seen as an additional option, but rather as a strategic need to maintain business sustainability (Gomez-Trujillo & Gonzalez-Perez, 2022). Ambon City as the center of economic activity in Maluku Province has challenges as well as opportunities in integrating MSMEs into the digital ecosystem. Variations in the level of technology adoption among MSME actors show that there are differences in readiness and ability to utilize digital platforms.

Digital transformation in MSMEs includes the use of social media, marketplaces, digital payments, and application-based bookkeeping systems to improve operational efficiency (Morisson & Fikri, 2025). The implementation of this technology allows businesses to expand their market reach without having to rely entirely on physical locations. In Ambon City, internet penetration and smartphone use have increased, thus opening up opportunities for digital market expansion for MSMEs. However, not all business actors are able to take advantage of these opportunities optimally due to limited digital literacy and access to financing. Differences in the level of technology adoption have the potential to create a gap in competitiveness between business actors. MSMEs that are more adaptive to technology tend to have wider market access and a faster response to changing demand. Thus, digital transformation is a key factor in strengthening the economic resilience of small-scale businesses in this city.

In Ambon City, MSMEs often face challenges such as fluctuations in demand, rising raw material costs, and limited access to distribution. Digital transformation offers a faster adaptation mechanism through the diversification of online-based sales and promotion channels. The use of marketplaces and delivery services can help MSMEs maintain sales volume when physical interaction is limited. In addition, digital payment systems simplify transactions and increase consumer trust.

The digital economy literature shows that the integration of technology in business processes is able to increase productivity and cost efficiency (Shostak et al., 2023). MSMEs that use social media for promotion can reduce conventional marketing costs and reach a wider market segment. In Ambon City, the development of a digital-based creative economy is beginning to be seen in the form of culinary and handicraft businesses that are active on online platforms. Access to financing is an important supporting factor in the digital transformation process of MSMEs. Initial investments for technology devices, internet connections, and digital promotions require sufficient capital support (Bahasoan et al., 2025). In Ambon City, some MSMEs still rely on personal capital or informal financing to run their businesses. Limited access to formal credit can hinder the ability of business actors to develop more aggressive digital strategies. Additionally, low financial literacy often limits technology-based investment planning. The relationship between access to finance and digital transformation is important to be analyzed in the context of economic resilience. With adequate capital support, MSMEs have a greater opportunity to adopt innovation and expand marketing networks (Dzikrullah & Chasanah, 2024).

The city of Ambon has the characteristics of an archipelago economy that affects the distribution structure and market access. The geographical distance between islands and relatively high transportation costs are often obstacles to business expansion. Digital transformation can reduce these barriers by bringing sellers and buyers together through online platforms without geographical boundaries. MSMEs that utilize application-based logistics systems can accelerate product delivery to consumers. Integration with delivery services also improves customer convenience and expands distribution reach. However, the success of this strategy depends on the readiness of digital infrastructure and the operational capabilities of business actors.

The measurement of the economic resilience of MSMEs is not only seen from the aspect of turnover growth, but also from the stability of cash flow and the ability to maintain business operations. Digital transformation can increase the diversification of revenue sources through various online sales channels. Such diversification reduces dependence on a single source of customers and strengthens revenue stability. In Ambon City, the variation in digital strategies between business actors shows that not all MSMEs benefit equally from technology. Factors such

as digital literacy and the quality of business management affect the effectiveness of technology implementation. Therefore, this study seeks to identify the combination of factors that have the most influence on economic resilience.

In addition to internal business factors, the external environment such as government support and access to digital training also influences the digital transformation process of MSMEs. Digital literacy training programs and financing assistance can accelerate the adoption of technology among small business actors. The city of Ambon has implemented several technology-based MSME empowerment initiatives. However, the effectiveness of the program needs to be analyzed through measurable indicators of economic resilience. Without empirical evaluation, it is difficult to know the extent to which digital transformation actually improves business resilience. MSMEs that are resilient and adaptive to technology can be the engine of economic growth in Ambon City. Digital transformation opens up opportunities for the integration of MSMEs in a wider value chain, including national and international markets. However, without an in-depth analysis of the determinants of economic resilience, MSME development strategies risk being less effective. Therefore, this study is designed to provide a comprehensive overview of the relationship between digitalization and business resilience.

METHODS

Approaches and Types of Research

This study uses a quantitative approach with the type of explanatory research. The quantitative approach is used because the research aims to measure the relationship and influence between independent variables and dependent variables based on numerical data obtained from respondents. Explanatory research is used to explain the influence of the use of digital technology, digital marketing, digital payments, digital literacy, and operational digitalization on the economic resilience of Micro, Small, and Medium Enterprises in Ambon City.

Population and Sample

The population in this study is all MSMEs that are actively carrying out business activities in Ambon City. The research analysis unit is MSMEs, while the observation unit is the owner or manager of MSMEs. The determination of the number of samples in this study refers to the practical guidelines for sample size in the analysis of Partial Least Squares-Structural Equation Modeling (PLS-SEM). Based on calculations with an approach of 10 times the number of question indicators, a minimum sample number of 190 respondents was obtained. The sampling technique uses *proportionate stratified random sampling* with the population divided by sub-district area or business field.

Data Analysis Techniques

This study uses the Partial Least Squares-Structural Equation Modeling (PLS-SEM) method as a data analysis technique. PLS-SEM is one of the approaches in structural equation modeling that is used to analyze the relationships between latent variables simultaneously. The analysis was carried out using Smart PLS software. Structurally, the research model can be formulated as follows:

$$\text{EXTRA} = \beta_1 \text{DO} + \beta_2 \text{LD} + \beta_3 \text{PBD} + \beta_4 \text{PD} + \epsilon$$

Description:

- KEU = Economic resilience of MSMEs
- DO = Operational digitalization
- LD = Digital literacy
- PBD = Digital payments
- PD = Digital marketing
- β_{1-4} = The path coefficient of each variable

- ϵ = Error or residual

The PLS-SEM analysis consists of two main parts, namely the measurement model (*outer model*) and the structural model (*inner model*). The evaluation of the measurement model was carried out through testing for convergent validity (outer loading > 0.70 and AVE > 0.50), discriminant validity (Fornell-Larcker, cross loadings, and HTMT < 0.90), and construct reliability (Cronbach's alpha and composite reliability > 0.70). The evaluation of the structural model was carried out through collinearity tests (VIF < 5), coefficient of determination (R^2), measure of influence (f^2), and predictive relevance ($Q^2 > 0$). Hypothesis testing was carried out by bootstrapping procedure using 5,000 subsamples at a significance level of 5%.

RESULTS AND DISCUSSION

RESULT

Evaluation of Measurement Models (*Outer Model*)

Convergent Validity

Convergent validity indicates the ability of each indicator to represent the construct it is measuring. The test results showed that all indicators had an *outer loading* between 0.758 and 0.908, with the lowest value at PBD2 (0.758) and the highest value at PD1 (0.908). Since the entire value is greater than 0.70, all indicators are declared valid and do not need to be eliminated. The *bootstrapping* results also showed that all *outer loading* had a t-statistic value much greater than 1.96, with a range of 12,304 to 70,682. Thus, all indicators are statistically significant in reflecting their respective constructs.

Based on the *Average Variance Extracted* (AVE) value, all constructs have an AVE above 0.50. Construct Operational Digitalization (DO) has AVE 0.788, MSME Economic Resilience (KEU) 0.739, Digital Literacy (LD) 0.738, Digital Payment (PBD) 0.586, and Digital Marketing (PD) 0.776. This shows that each construct is able to explain more than 50% of the variance of its indicators. PBD has the lowest AVE (0.586), but it is still above the minimum limit.

Construct Reliability

Reliability was measured using Cronbach's alpha, ρ_A , and *composite reliability*. Cronbach's alpha values are between 0.770 and 0.882, while *composite reliability* is between 0.850 and 0.919. The KEU construct has the highest Cronbach's alpha (0.882), while the PBD has the lowest value (0.770). Nonetheless, PBD reliability is still acceptable because the entire reliability measure is greater than 0.70. Thus, all constructs have good internal consistency.

Discriminatory Validity

Based on the Fornell-Larcker criteria, the square root of AVE of each construct is greater than its correlation with the other construct. The highest correlation was found between DO and KEU (0.741) and between PBD and PD (0.735). Although the correlation is relatively high, the value is still lower than the square root of the AVE of each construct. The results of *cross loadings* also show that each indicator has the highest load on the construct that should be measured.

Based on the Heterotrait-Monotrait Ratio (HTMT) criteria, most HTMT values are less than 0.90. However, the HTMT value between PBD and PD of 0.911 slightly exceeded the limit of 0.90. This indicates that the discriminatory validity between PBD and PD has not been fully fulfilled based on the HTMT criteria, which indicates a potential empirical overlap between the two constructs.

Evaluation of Structural Models (*Inner Model*)

Collinearity Test

The indicator's *outer VIF* value is between 1.321 and 3.038, while the entire *inner VIF* value is less than 5 (even most of it is still below the conservative limit of 3.3). Thus, there is no serious problem of multicollinearity in the indicators or between independent variables in explaining the KEU.

Coefficient of Determination (R^2)

The R^2 value of KEU of 0.650 indicates that DO, LD, PBD, and PD together are able to explain 65.0% of the variation in KEU. The remaining 35.0% was explained by other variables outside the research model. An *adjusted* R^2 value of 0.643 indicates that after considering the number of predictors in the model, the model's explainability remains at 64.3%. The small difference between R^2 and *adjusted* R^2 suggests that the use of four exogenous variables does not cause an excessive increase in R^2 . In general, the R^2 value of 0.650 can be categorized as moderate to strong, so that the model has a fairly good explanatory ability to the KEU.

Effect Size (f^2)

The value of f^2 indicates the magnitude of the contribution of each exogenous construct to the R^2 of the endogenous construct. Operational Digitalization (DO) has the greatest effect on KEU with an f^2 of 0.430 (large category). Digital Literacy (LD) has an f^2 of 0.112 (small category, close to medium). Digital Payments (PBD) and Digital Marketing (PD) have f^2 of 0.006 and 0.011 respectively (very small/insignificant). These findings are consistent with the results of hypothesis testing which show that the two relationships are not significant.

Predictive Relevance (Q^2)

The Q^2 value of the KEU of 0.472 is greater than zero, which indicates that the model has a predictive relevance to the KEU. With a guideline value of 0.02 as small, 0.15 medium, and 0.35 large, a Q^2 of 0.472 indicates great predictive relevance. The results of *cross-validated communality* were also positive for all constructs (DO: 0.546; SIZE: 0.555; LD: 0.458; PBD: 0.305; PD: 0.526), which supports that the measurement model is able to adequately reconstruct observational data.

Hypothesis Testing

Hypothesis testing was carried out through a *bootstrapping procedure* with 5,000 subsamples. A summary of the hypothesis test results is presented in Table 1.

Table 1. Hypothesis Testing Results

Hypothesis	Relationships	Coefficients	T-Statistics	p-value	CI 95%	Verdict
H1	DO → EXTRAS	0,492	8,351	<0.001	0,393–0,603	Accepted
H2	LD → EXTRA	0,287	4,397	<0.001	0,160–0,406	Accepted
H3	PBD → KEU	0,077	1,109	0,268	−0.053–0.205	Rejected
H4	PD → EXTRA	0,091	1,274	0,203	−0.044–0.231	Rejected

The resulting structural equations are:

$$\text{EXTRA} = 0.492 \text{ DO} + 0.287 \text{ LD} + 0.077 \text{ PBD} + 0.091 \text{ PD} + \epsilon$$

DISCUSSION

The Effect of Operational Digitalization on the Economic Resilience of MSMEs

The first hypothesis states that Operational Digitalization (DO) has a positive effect on the Economic Resilience of MSMEs (KEU). The test results showed a path coefficient of 0.492, a t-statistic of 8.351, and a p-value of less than 0.001. A positive coefficient value shows that increasing Operational Digitalization tends to increase the Economic Resilience of MSMEs. The 95% confidence interval is between 0.393 and 0.603, all of which are positive and do not include zeros, thus strengthening the conclusion that Operational Digitalization has a significant effect on the Economic Resilience of MSMEs. Thus, H1 is accepted.

Substantively, these results show that the use of digital technology in operational activities, such as inventory management, transaction recording, order management, internal communication, and business administration, can increase the efficiency and ability of MSMEs to adapt to changes in the business environment. Operational Digitalization is also the most dominant variable affecting the Economic Resilience of MSMEs because it has the largest path coefficient. The better the implementation of Operational Digitalization, the stronger the ability of MSMEs to maintain business activities, adapt to disruptions, and maintain economic sustainability.

The Influence of Digital Literacy on the Economic Resilience of MSMEs

The second hypothesis states that Digital Literacy (LD) has a positive effect on the Economic Resilience of MSMEs (KEU). The test results showed a path coefficient of 0.287, a t-statistic of 4.397, and a p-value of less than 0.001. The 95% confidence interval is between 0.160 and 0.406, which does not include zeros, thus confirming that the influence of Digital Literacy on MSME Economic Resilience is significant. Thus, H2 is accepted.

The coefficient of 0.287 shows that the increase in Digital Literacy will be followed by an increase in the Economic Resilience of MSMEs. Digital Literacy allows MSME actors to understand, choose, use, and evaluate digital technology according to their business needs. This ability helps business actors access market information, communicate with consumers, use business applications, avoid digital risks, and make decisions faster and more precisely. These results show that digital technology is not enough just available; MSME actors must also have the knowledge and skills to utilize it. The higher the Digital Literacy of MSME actors, the greater their ability to adapt to changes and maintain business sustainability.

These findings are supported by Susanto et al. (2026), which prove that digital literacy encourages the use of technology and digital transformation of SMEs. These results are also conceptually in line with Hokmabadi et al. (2024), which position digital skills and knowledge management as important capabilities in building the resilience of small businesses. Thus, Digital Literacy plays a role as a basic ability that allows MSME actors to turn technology into productive resources to maintain their business sustainability.

The Influence of Digital Payments on the Economic Resilience of MSMEs

The third hypothesis states that Digital Payments (PBD) have a positive effect on the Economic Resilience of MSMEs (KEU). The test results showed a positive path coefficient of 0.077, a t-statistic of 1.109, and a p-value of 0.268. The t-value is smaller than 1.96 and the p-value is greater than 0.05, so H3 is rejected. The 95% confidence interval is between -0.053 and 0.205, which includes zero, so the influence of Digital Payments cannot be statistically ascertained.

A positive coefficient of 0.077 shows that Digital Payments have a positive relationship with MSME Economic Resilience. However, the magnitude of the relationship is very weak and not strong enough to be declared significant. Thus, the use of digital payments has not directly become the main factor that increases the economic resilience of MSMEs. This condition can occur if digital payments are only used as a means of receiving payments, but have not been integrated with financial records, cash flow management, transaction control, and business planning. In addition, some consumers may still use cash so that the existence of digital payments has not directly increased sales or business resilience.

This result does not mean that Digital Payments are not beneficial. Digital Payments can still provide ease of transactions, but these benefits are not strong enough to increase the Economic Resilience of MSMEs when Operational Digitalization, Digital Literacy, and Digital Marketing are taken into account at the same time. These findings support the argument of Pratama & Azzahra (2026) that the use of fintech alone is not enough to strengthen the resilience of MSMEs if it is not followed by meaningful digital financial inclusion. The findings of this study are also in line with Susanto et al. (2026), who show that the use of digital technology alone does not produce a direct influence on the performance of SMEs without a more comprehensive digital transformation. However, these results are different from those of Affandi et al. (2024), who found

a positive relationship between the digital adoption index and business performance. The difference is thought to occur because Affandi et al. used a combined index of several digital processes, while this study tested Digital Payments as a separate construct.

The Influence of Digital Marketing on the Economic Resilience of MSMEs

The fourth hypothesis states that Digital Marketing (PD) has a positive effect on the Economic Resilience of MSMEs (KEU). The test results showed a path coefficient of 0.091, a t-statistic of 1.274, and a p-value of 0.203. The t-value is smaller than 1.96 and the p-value is greater than 0.05, so H4 is rejected. The 95% confidence interval is between -0.044 and 0.231, which includes zero, so the influence of Digital Marketing on the Economic Resilience of MSMEs has not been statistically proven.

A coefficient of 0.091 indicates a positive relationship direction, but its strength is relatively small. This means that the increase in Digital Marketing tends to be followed by an increase in the Economic Resilience of MSMEs, but the relationship is not strong enough to be generalized to the research population. The insignificance of this influence can show that the use of social media, marketplaces, and digital channels by MSMEs has not fully resulted in a stable increase in sales. Digital marketing may still be done simply, inconsistently, not yet based on consumer analysis, or not supported by the ability to create content and evaluate the effectiveness of promotions. As a result, digital marketing activities have not directly strengthened the economic resilience of MSMEs.

In addition, the HTMT value between Digital Payment and Digital Marketing of 0.911 shows that the two constructs have a high empirical closeness. This is important because respondents may view digital payments and marketing as part of interrelated business digitization practices. These findings indicate that the use of social media or marketplaces has not automatically formed economic resilience if it is not accompanied by marketing strategies (Hokmabadi et al., 2024), consumer analysis capabilities, content consistency, and integration with other business processes. These results are supported by Susanto et al. (2026), who found that the use of digital technology alone has no direct effect on the performance of SMEs without comprehensive digital transformation. However, these findings differ from those of Affandi et al. (2024), who found a positive relationship between digital adoption indexes, including digital marketing, and business performance. This difference can be caused by differences in the operationalization of variables, research objects, and regional contexts.

CONCLUSION

Based on the results of the analysis using Partial Least Squares-Structural Equation Modeling (PLS-SEM), this study concludes that the model built has a fairly good ability to explain the economic resilience of MSMEs. Operational Digitalization, Digital Literacy, Digital Payments, and Digital Marketing together are able to explain 65.0% of the variation in MSME Economic Resilience. Meanwhile, the remaining 35.0% was explained by other factors that were not included in the research model. The Q^2 value of 0.472 also shows that the model has strong predictive relevance in predicting the Economic Resilience of MSMEs.

Partially, Operational Digitalization has a positive and significant effect on the Economic Resilience of MSMEs. Operational Digitalization is the variable that has the most dominant influence, with a path coefficient of 0.492.

On the other hand, Digital Payments do not have a significant effect on the Economic Resilience of MSMEs. Although the path coefficient was positive at 0.077, the t-statistical value of 1.109 and the p-value of 0.268 showed that the effect had not been statistically proven.

Suggestions

MSME actors are advised to prioritize Operational Digitalization because this variable has been proven to have the greatest influence on the Economic Resilience of MSMEs. Digital technology should be used in an integrated manner in transaction recording, inventory management, cost control, order management, customer relations, and simple financial reporting. MSME actors also need to improve digital literacy in a sustainable manner, not only in the ability to use devices and applications, but also in digital security, data protection, information management, business application evaluation, and data-based decision-making. Digital payments should not only be used as an alternative to receiving payments, but integrated with sales and cash flow records. Digital marketing needs to be carried out more strategically by determining target consumers, choosing the right media, creating content consistently, and evaluating promotional results.

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