

E-commerce and digital payment adoption and MSME income: Survey evidence from Manado City, Indonesia

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ABSTRACT

This study examines the partial effects of e-commerce and digital payment adoption on perceived income among Micro, Small, and Medium Enterprises (MSMEs) in Manado City, Indonesia, within the framework of the Technology Acceptance Model (TAM). Primary data were collected from a purposive sample of 100 MSME owners who had adopted both technologies, using a five-point Likert questionnaire, and analyzed through multiple linear regression. The results show that e-commerce has a positive but statistically insignificant partial effect on perceived MSME income, whereas digital payment has a positive and significant partial effect. Jointly, the two predictors explain only a modest share of the variance in perceived MSME income, indicating that most of the variation is driven by factors outside the model. These contrasting results suggest that, in a digitally low-readiness eastern-Indonesian setting, perceived usefulness and ease of use translate into income gains more readily for a transactionally self-contained technology such as digital payment than for a capability-dependent technology such as e-commerce, refining the boundary conditions of the Technology Acceptance Model for MSME digitalization research. Practical implications for strengthening MSME digital adoption in secondary Indonesian cities are discussed.

Keywords: digital payment; e-commerce; Manado City; MSME digitalization; perceived MSME income; technology acceptance model

JEL Classification: L81; G23

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1. Introduction

Micro, Small, and Medium Enterprises (MSMEs) make a major contribution to the national economy, particularly in absorbing labor and forming Gross Domestic Product (GDP). Their strategic role makes MSMEs one of the main pillars in supporting inclusive and sustainable

economic growth. Consequently, the sustainability and improvement of MSME performance, especially in terms of income, is an important factor in maintaining economic stability and growth at both the national and regional levels.

Along with technological progress, the global economy has undergone a

transformation toward the digital era, changing business activities from production and marketing to transaction systems. The use of technologies such as e-commerce enables business actors to expand their market reach without geographical limits, while digital payment provides fast, practical, and efficient transactions. These two technologies have become important factors in improving the competitiveness of MSMEs in the digital era. Data from Statistics Indonesia show that the value of e-commerce transactions in Indonesia reached Rp1,288.93 trillion in 2024, growing 17.08% from the previous year, while the number of e-commerce users is projected to reach 99.1 million by 2029 (Badan Pusat Statistik, 2024).

In the regional context, Manado City has around 27,500 active MSME units, of which only a subset has adopted e-commerce and digital payment (Dinas Koperasi dan UMKM Kota Manado, 2024). These MSMEs play an important role in supporting the local economy. However, the level of e-commerce and digital-payment adoption among these MSMEs is not yet optimal. Many MSMEs still operate conventionally and have not fully utilized digital technology; although digital-payment methods such as QRIS, OVO, Dana, ShopeePay, GoPay, and mobile-banking transfers are increasingly used, their adoption at the MSME level remains uneven, influenced by limited digital literacy, technological readiness, and differing adaptive capacities. This condition indicates a gap between the potential of digitalization and its implementation on the ground, which may hinder income growth and competitiveness.

Theoretically, technology adoption by business actors can be explained through the Technology Acceptance Model (TAM) proposed by Davis (1989), which holds that technology acceptance is influenced by perceived ease of use and perceived usefulness. In this study, TAM is used as a

framing device rather than as a fully specified structural model: perceived usefulness and perceived ease of use are not modeled as separate antecedent constructs but are embedded within the e-commerce and digital-payment indicators themselves (see Table 1). The study therefore tests the adoption–outcome link implied by TAM—whether perceived usefulness and ease of use, as reflected in reported adoption behavior, translate into perceived income gains, rather than the full causal chain from attitude to intention to use. E-commerce refers to buying and selling transactions conducted through digital platforms using the internet (Turban et al., 2018), while digital payment refers to non-cash payment methods carried out through digital, internet-based electronic systems (Setiawan and Mahyuni, 2020). Income, in turn, is the increase in economic benefits obtained from operating activities within a period that increases equity and does not derive from owner investment (Ikatan Akuntan Indonesia, 2007); in the present study this construct is operationalized perceptually.

Prior studies show mixed results. Siregar et al. (2025), Titasari (2023), and Mutia and Ruzikna (2024) found that e-commerce and digital payment have a positive and significant effect on MSME income in western Indonesian settings (Medan, Yogyakarta, and Pekanbaru, respectively). By contrast, cross-country evidence indicates that digital-technology adoption in developing economies still faces infrastructure, digital-literacy, and readiness constraints that can attenuate its effect on business outcomes (Nazir and Roomi, 2020). This divergence suggests a theoretical boundary condition rather than a purely geographic one: where enabling infrastructure and digital readiness are still developing, perceived usefulness and ease of use may not yet translate into realized income gains, even when adoption itself has occurred. Most of the prior Indonesian studies cited above were conducted in

western Indonesia (e.g., Yogyakarta, Pekanbaru, Medan), where digital infrastructure and MSME digital literacy are relatively more established; eastern Indonesian cities such as Manado, where digital adoption remains comparatively low and uneven, offer a setting in which this boundary condition of TAM can be empirically examined. This constitutes the research gap addressed by the present study: rather than merely replicating prior designs in a new location, the study tests whether the adoption–income relationship documented in higher-readiness settings holds in a lower-readiness eastern-Indonesian context, and specifically whether e-commerce and digital payment, two technologies with different implementation complexity, exhibit the same or different patterns of effect. Accordingly, this study examines empirically the partial effect of e-commerce (X_1) and digital payment (X_2) on perceived MSME income (Y) in Manado City.

2. Literature review

Technology Acceptance Model (TAM)

The Technology Acceptance Model (Davis, 1989) explains that an individual's acceptance and use of technology is determined by perceived usefulness and perceived ease of use. In the MSME context, when owners perceive e-commerce and digital payment as useful and easy to use, they are more likely to adopt them in their business activities, which can improve efficiency, expand markets, and ultimately increase income. This model provides the theoretical basis for linking the adoption of e-commerce and digital payment to MSME income. However, TAM's core prediction, that perceived usefulness and ease of use translate into improved outcomes is conditional on adopters being able to realize that usefulness in practice, a boundary condition this study examines empirically for e-commerce.

TAM's prediction is, however, conditional. Its extension, the unified theory of acceptance and use of technology, adds facilitating conditions, that is, the organizational and technical resources that support use (Venkatesh et al., 2003). Where complementary capabilities such as catalog management, logistics, and digital-marketing skills are weak, perceived usefulness may not be realized in practice, and adoption alone may not generate income gains. Conversely, a technology whose benefits are embedded in a single transaction step requires fewer complementary capabilities. This competing view anticipates that the two technologies studied here may behave differently in a lower-readiness setting.

E-commerce and MSME income

E-commerce is the use of internet-based digital platforms for marketing and selling products without geographical limits, enabling MSMEs to reach wider markets and increase sales volume (Turban et al., 2018). Prior studies by Siregar et al. (2025), Dalimunthe (2025), Titasari (2023), and Mutia and Ruzikna (2024) found that e-commerce has a positive and significant effect on MSME income in their respective study settings. Based on this reasoning, the first hypothesis is proposed:

H₁: E-Commerce has a positive effect on MSME Income in Manado City

Digital payment and MSME income

Digital payment is a technology-based non-cash payment system offering ease, speed, and security in transactions. Based on technology-adoption theory, the perceived ease and usefulness of digital payment can encourage MSMEs to use it continuously, improving operational efficiency, smoothing cash flow, and enhancing customer convenience, which ultimately increases income (Setiawan and Mahyuni, 2020). Siregar et al. (2025), Titasari (2023), Mutia and Ruzikna (2024),

and Khotmi et al. (2024) found that digital payment has a positive and significant effect on MSME income and performance. Based on this reasoning, the second hypothesis is proposed:

H₂: Digital Payment has a positive effect on MSME Income in Manado City

Conceptual Framework

Figure 1 summarizes the hypothesized relationships: e-commerce (X₁) and digital

payment (X₂) are each hypothesized to have a direct, positive partial effect on perceived MSME income (Y), consistent with H₁ and H₂ above and with the TAM-based reasoning that perceived usefulness and ease of use of each technology encourage adoption behaviors that, in turn, are expected to be associated with higher perceived income.

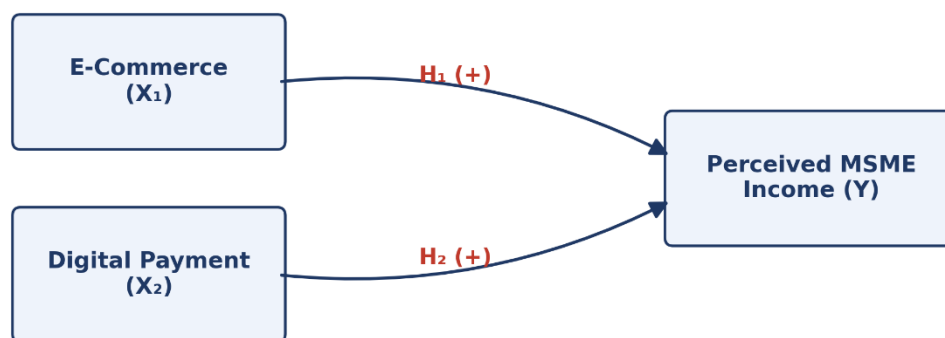


Figure 1. Conceptual framework

3. Research method

This study uses a quantitative, cross-sectional survey method to test the effect of the independent variables, e-commerce (X₁) and digital payment (X₂), on the dependent variable, perceived MSME income (Y). The population comprises all MSMEs in Manado City (around 27,500 active units; Dinas Koperasi dan UMKM Kota Manado, 2024), of which only those actively using e-commerce platforms and digital-payment systems were eligible for sampling. The sample was selected using purposive sampling (Sugiyono, 2019) based on the following criteria: MSMEs operating in Manado City during the study period; MSMEs that have used e-commerce as a means of promotion and/or sales; MSMEs that have used digital payment as a transaction method; and MSMEs willing to complete the questionnaire fully. Based on these

criteria, 100 MSME owners were selected as respondents, exceeding the minimum sample size of 66 suggested by the rule of thumb $n \geq 50 + 8m$ for multiple regression with $m = 2$ predictors (Hair et al., 2019).

Because the sampling criteria require prior adoption of e-commerce and digital payment, the sample necessarily consists of MSMEs that have already adopted both technologies (self-selected adopters). This design choice is appropriate for testing the adoption-income relationship among adopters, but it means the findings describe the effect of adoption intensity/perceived usefulness among users rather than the effect of the initial adoption decision itself, and the results should not be generalized to the wider population of non-adopting MSMEs in Manado City (see Section 5, Limitations).

Primary data were collected through structured questionnaires measured on a

five-point Likert scale (1 = strongly disagree to 5 = strongly agree), distributed both in person and online to respondents

meeting the sampling criteria. The operationalization of each variable is summarized in Table 1.

Table 1. Variable operationalization and indicators

Variable	Definition	Indicators
E-Commerce (X ₁)	The extent to which MSMEs use internet-based digital platforms in marketing and sales activities.	Intensity of platform use; ease of use; perceived usefulness in increasing sales; market-reach expansion; effectiveness of digital promotion.
Digital Payment (X ₂)	The extent to which MSMEs use technology-based non-cash payment systems in business transactions.	Use of QRIS/mobile-banking transfer; ease of transactions; speed of transactions; security of transactions; smoothness of cash flow.
Perceived MSME Income (Y)	Owners' perception of business revenue performance obtained from sales activities within a period, as reported on a Likert-scale instrument (see Section 5 for the resulting construct-validity limitation).	Increase in turnover; sales growth; income stability; ability to cover operating costs; perceived income increase after digitalization.

Source: Adapted from Davis (1989); Turban et al. (2018); Ozili (2018); Setiawan and Mahyuni (2020); processed (2026)

Note on the income construct

Consistent with the questionnaire instrument, MSME income (Y) is measured perceptually, as owners' self-reported perception of turnover growth, income stability, and perceived income increase after digitalization, rather than as actual, verifiable monetary revenue. This construct is therefore labeled "perceived MSME income" throughout this article to accurately reflect what was measured. Because both the predictors and the outcome are self-reported by the same respondent in a single instrument, the results should be interpreted as reflecting associations among owners' perceptions rather than as a direct estimate of the effect of digitalization on realized monetary income; this limitation, and its implications for common-method bias, are discussed further in Section 5.

Data were analyzed using instrument tests (validity via Pearson product-moment correlation, with an item considered valid

at Sig. < 0.05, following Ghazali, 2018; and reliability via Cronbach's alpha), classical assumption tests (normality via the one-sample Kolmogorov-Smirnov test, multicollinearity via tolerance and VIF, and heteroscedasticity via the Glejser test and scatterplot), and multiple linear regression, processed with IBM SPSS version 27. The regression model is specified as:

$$Y = \alpha + \beta_1 X_1 + \beta_2 X_2 + \varepsilon$$

where Y = perceived MSME income, X₁ = e-commerce, X₂ = digital payment, α = constant, β_1 and β_2 = regression coefficients, and ε = error term. Hypotheses were tested using the individual parameter significance test (t-test) at the 5% level; the overall model significance was assessed with the F-test, and the coefficient of determination (Adjusted R²) was used to assess explanatory power.

Because all three constructs were captured through a single self-administered questionnaire completed by a single respondent per firm, common-method bias (CMB) is a plausible threat to the observed associations. Anonymity of respondents was assured during data collection as a procedural safeguard, but a statistical CMB diagnostic (e.g., Harman's single-factor test) was not performed in this study; this is acknowledged as a limitation in Section 5, and readers should

interpret the magnitude of the reported coefficients with this caveat in mind.

4. Result and discussion

Respondent profile

Of the 100 questionnaires distributed to MSME owners meeting the sampling criteria, all 100 were returned complete and usable. Table 2 summarizes the demographic and business-profile characteristics of the respondents.

Table 2. Respondent profile

Characteristic	Category	n	%
Gender	Male	34	34%
Gender	Female	66	66%
Age	Unknown	1	1%
Age	20–25 years	18	18%
Age	26–30 years	46	46%
Age	31–35 years	12	12%
Age	> 35 years	23	23%
Business sector	Culinary (food/beverage)	84	84%
Business sector	Trade (kiosk/store)	3	3%
Business sector	Fashion (apparel)	4	4%
Business sector	Services	9	9%
Business tenure	Unknown	2	2%
Business tenure	1 year	8	8%
Business tenure	2 years	13	13%
Business tenure	3 years	23	23%
Business tenure	> 3 years	54	54%

Source: Processed primary data (2026); n = 100

The sample is predominantly female (66%), aged 26–30 years (46%), engaged in the culinary sector (84%), and operating for more than three years (54%). This sector concentration should be borne in

mind when interpreting the generalizability of the findings.

Descriptive statistics

Table 3 presents the descriptive statistics for the three research variables.

Table 3. Descriptive statistics

Variable	N	Min	Max	Mean	SD
E-Commerce (X ₁)	100	35	50	42.29	3.540
Digital Payment (X ₂)	100	35	50	41.11	3.213
Perceived MSME Income (Y)	100	33	50	39.94	2.486

Note: Total scores of ten Likert items (possible range 10–50). Source: Processed primary data (2026).

For all three variables, the mean substantially exceeds the standard deviation, indicating relatively homogeneous responses with no marked divergence among respondents. The e-commerce variable shows the highest mean (42.29) with moderate dispersion (SD = 3.540), suggesting a fairly high perceived level of e-commerce use among respondents; digital payment likewise shows a high mean (41.11) with low dispersion (SD = 3.213); and perceived income shows the lowest dispersion of the three variables (SD = 2.486), indicating

comparatively stable income perceptions across respondents.

Instrument tests: Validity and reliability

The validity test using Pearson product-moment correlation shows that all questionnaire items for the three variables (e-commerce, digital payment, and perceived MSME income) are valid, each with a significance value below 0.05 (Ghozali, 2018). The reliability test shows that all variables have Cronbach's alpha above 0.60, as presented in Table 4, confirming that the instrument is reliable.

Table 4. Reliability test results

Variable	Cronbach's Alpha	Standard	Conclusion
E-Commerce (X ₁)	0.851	0.60	Reliable
Digital Payment (X ₂)	0.826	0.60	Reliable
Perceived MSME Income (Y)	0.819	0.60	Reliable

Note: Reliability criterion, Cronbach's Alpha > 0.60. Item-level correlation coefficients are available from the authors on request. Source: Processed primary data (2026), n = 100.

Classical assumption tests

The results of the classical assumption tests are summarized in Table 5. The one-sample Kolmogorov-Smirnov test yields an Asymp. Sig. (2-tailed) of 0.200 (> 0.05), confirming normally distributed residuals, supported by the histogram and P-P plot. Both independent variables have a tolerance of 0.901 (> 0.10) and a VIF of 1.110 (< 10), indicating no multicollinearity. The Glejser test

produces significance values of 0.855 for e-commerce and 0.767 for digital payment (both > 0.05), and the scatterplot shows no clear pattern, indicating no heteroscedasticity. All classical assumptions are therefore satisfied. The histogram, normal P-P plot, and scatterplot underlying these diagnostics are available from the corresponding author upon request.

Table 5. Summary of classical assumption tests

Test	Criterion	Result	Conclusion
Normality (Kolmogorov-Smirnov)	Asymp. Sig. > 0.05	0.200	Normal
Multicollinearity	Tolerance > 0.10; VIF < 10	0.901; 1.110	None
Heteroscedasticity (Glejser)	Sig. > 0.05	0.855; 0.767	None

Multiple linear regression and hypothesis testing

The results of the multiple linear regression and the individual parameter

significance test (t-test) are presented in Table 6.

Table 6. Multiple linear regression and t-test results

Variable	Coefficient (B)	t	Sig.	Conclusion
(Constant)	26.058	—	—	—
E-Commerce (X ₁)	0.070	0.773	0.441	H ₁ rejected
Digital Payment (X ₂)	0.317	3.363	0.001	H ₂ accepted

Dependent variable: Perceived MSME Income (Y). t-table (df = 97) = 1.984; n = 100; B = unstandardized regression coefficient

Based on Table 6, the regression equation is $Y = 26.058 + 0.070X_1 + 0.317X_2 + \varepsilon$. E-commerce has a t-value of 0.773 ($< t\text{-table } 1.984$) with a significance of 0.441 (> 0.05), so H₁ is rejected—e-commerce has no significant partial effect on perceived MSME income. Digital

payment has a t-value of 3.363 (> 1.984) with a significance of 0.001 (< 0.05), so H₂ is accepted—digital payment has a positive and significant partial effect on perceived MSME income. The overall model significance and the coefficient of determination are presented in Table 7.

Table 7. Model fit: f-test and coefficient of determination

Model	F	df1	df2	Sig. (F)	R	R Square	Adjusted R ²
1	7.76	2	97	< 0.001	0.371	0.138	0.116

Note: F, R, and R Square are derived from the reported Adjusted R² (0.116), t-values, and tolerance using Equation (2) with k = 2 and n = 100. Source: Processed primary data (2026).

The F-test indicates that the overall regression model is statistically significant ($F(2, 97) = 7.76, p < 0.001$), confirming that e-commerce and digital payment jointly explain a significant, albeit modest, share of the variation in perceived MSME income. The Adjusted R² of 0.116 indicates that e-commerce and digital payment jointly explain 11.6% of the variation in perceived MSME income, while the remaining 88.4% is explained by other factors outside the model, such as capital, product quality, business location, managerial capability, marketing strategy, and digital literacy. This low explanatory power should temper the strength of conclusions that can be drawn about the overall determinants of MSME income: while the model identifies a statistically reliable partial effect of digital payment, the two technology variables considered here are far from sufficient to explain MSME income performance as a whole.

Discussion

The effect of e-commerce on perceived msme income

E-commerce has a positive but statistically insignificant effect on perceived MSME income, so H₁ is rejected. This indicates that the use of e-commerce has not yet become a decisive factor in increasing perceived income among MSMEs in Manado City. A plausible explanation is that e-commerce adoption, while present in the sampled MSMEs, remains uneven in intensity: many MSMEs still rely on direct sales, use digital platforms only as a complementary promotional channel, and face constraints in digital literacy, product-catalog management, logistics, and price competition, online prices are, in some cases, higher than offline prices once shipping, handling, and platform fees are included, which can lead consumers to prefer direct purchase. Within the TAM framework, when perceived usefulness and ease of use have not been fully realized in

practice, adoption does not translate into higher perceived income.

This result diverges from studies conducted in more digitally mature western-Indonesian settings that report a significant e-commerce effect (Siregar et al., 2025; Titasari, 2023; Mutia & Ruzikna, 2024; Dalimunthe, 2025); this divergence is unlikely to be explained by measurement alone, since income was operationalized similarly across these studies, and is more plausibly attributable to differences in e-commerce adoption intensity, sectoral composition (the present sample is dominated by culinary MSMEs, where informal and direct-sales channels remain strong), and the lower digital-readiness context of Manado relative to western Indonesian cities, consistent with evidence that digital-technology adoption in developing-economy contexts continues to face infrastructure and readiness constraints that can attenuate its effect on business outcomes (Nazir and Roomi, 2020).

The effect of digital payment on perceived msme income.

Digital payment has a positive and significant effect on perceived MSME income, so H_2 is accepted. The use of non-cash payment systems such as QRIS and mobile-banking transfers improves transaction speed, convenience, and security, smooths cash flow, and encourages purchases, which contributes to higher perceived income. Within the TAM framework, digital payment is perceived as both useful and easy to use, so its adoption more directly translates into improved business performance. This result is consistent with Siregar et al. (2025), Titasari (2023), Mutia and Ruzikna (2024), and Khotmi et al. (2024). Practically, it suggests that strengthening digital-payment adoption, alongside efforts to raise e-commerce readiness, can support MSME income growth in Manado City.

Why e-commerce and digital payment diverge

Taken together, the contrasting results for two nominally similar digital technologies suggest that adoption alone, as captured by the Likert-based indicators used here, is not a uniform predictor of perceived income gains. Digital payment functions as a relatively self-contained tool embedded directly in the point-of-sale transaction, so its benefits (speed, security, cash-flow smoothing) are realized immediately upon use. E-commerce, by contrast, requires complementary capabilities, catalog management, digital marketing, logistics, and competitive pricing for its perceived usefulness to be realized as higher income; where these complementary capabilities are still developing, as appears to be the case for many MSMEs in Manado, adoption of e-commerce may not by itself be sufficient to generate a measurable income effect. This refines the TAM-based expectation with which the study began: perceived usefulness and ease of use are necessary but, for more complex technologies such as e-commerce, not always sufficient conditions for realized outcome gains in a low-readiness adoption context.

5. Conclusion

In this sample of adopting MSMEs in Manado City, digital payment has a positive and significant partial effect on perceived MSME income (Sig. = 0.001), whereas e-commerce has no significant partial effect (Sig. = 0.441); the model is significant overall ($F(2, 97) = 7.52$; Sig. < 0.001) but explains only 11.6% of the variation (Adjusted R^2). This divergence refines the Technology Acceptance Model (TAM) for low-readiness MSME settings: perceived usefulness and ease of use translate into perceived outcomes more directly for a transactionally self-contained technology (digital payment) than for a capability-dependent one (e-commerce), whose benefits rely on complementary

capabilities. Future TAM applications should therefore distinguish technologies by implementation complexity and model such capabilities, in line with the facilitating conditions of Venkatesh et al. (2003), as moderating conditions on the usefulness–outcome link.

Practically, MSME owners are encouraged to develop e-commerce as a primary sales channel through better catalog management, customer service, promotion, and pricing while continuing to expand digital payment, supported by local government and platform-provider training and mentoring that target e-commerce capability rather than platform registration alone. The findings are qualified by five limitations, each pointing to future research: income is perceptual and partly attributed to digitalization (use objective revenue data); single-source data leave common-method bias untested (apply Harman's single-factor test or a marker variable, and separate data sources); the purposive sample of self-selected adopters limits generalization to non-adopters (use probability sampling that includes non-adopters); the sample is concentrated in the culinary sector (84%) in one city at one time (use multi-city, multi-sector, or longitudinal designs); and the model omits variables such as digital literacy and managerial capability (add them as moderators or mediators).

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