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Digital Payments, Ecosystem Age, and Islamic Ethics in Cross-Provincial E-Commerce Revenue

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Abstract

E-commerce revenue maturity varies across Indonesian provinces, but the factors driving this variation are poorly understood in isolation. This study examined the relationship between three digital ecosystem factors ecosystem age, digital payment intensity, and sales channel profiles and e-commerce revenue maturity using a cross-sectional design with secondary data from BPS Statistik E-Commerce 2023. Canonical correlation analysis revealed that the first canonical function was significant ($Rc = 0.78$, $p < 0.001$), indicating that the three factors collectively explained a substantial proportion of variance in revenue maturity. Social commerce channel configuration contributed most strongly, followed by digital payment intensity, while ecosystem age played a supporting role. From an Islamic ethics perspective, these results require that social commerce growth and digital payment expansion uphold 'adl (justice) by ensuring equitable access for underserved provinces such as Aceh and Central Kalimantan, amanah (trustworthiness) through transparent data and honest marketing, and maslahah (public interest) by prioritizing community welfare over platform profits. The study concludes that strengthening social commerce and digital payment infrastructure is essential for e-commerce revenue maturity, and that these factors operate as an integrated system grounded in Islamic commercial ethics.

Keywords

Digital payment intensity; E-Commerce Revenue Maturity' Ecosystem Age; Islamic Business Ethics; Sales Channel Profile; Social Commerce.

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1. INTRODUCTION

E-commerce has emerged as a transformative force in Indonesia's digital economy, with the sector recording 3,816,750 business units in 2023, representing 41.51 percent of all businesses nationwide (BPS 2023). However, beneath this impressive aggregate growth lies a more nuanced reality: the revenue maturity of e-commerce enterprises varies substantially across provinces, creating a digital divide that cannot be explained solely by the presence or absence of marketplace platforms. While national transaction values reached Rp1,288.93 trillion in 2024, growing 17.08 percent from the previous year, the distribution of high-revenue e-commerce businesses those earning more than Rp2 billion annually

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remains strikingly uneven, with the average Revenue Maturity Index (RMI) across 36 provinces standing at only 3.52 percent (BPS 2023). This disparity raises a fundamental question: beyond simply adopting marketplace platforms, what factors enable e-commerce businesses in some provinces to achieve substantially higher revenue maturity than others?

From a digital economic geography perspective, three organizational and technological factors consistently emerge as potential determinants of e-commerce revenue maturity: ecosystem age (AGE), digital payment intensity (DPI), and sales channel profiles. Ecosystem age, measured as the percentage of e-commerce businesses that commenced commercial operations before 2020, reflects the accumulated experience, market knowledge, and network effects that mature businesses leverage to generate higher revenues (BPS 2023).

Digital payment intensity, operationalized as the combined adoption of e-wallets and QRIS (Quick Response Code Indonesian Standard), captures the depth of digital financial integration that reduces transaction friction and expands market reach. Meanwhile, sales channel profiles, whether businesses rely primarily on marketplaces, social media, instant messaging, or hybrid strategies, determine how e-commerce enterprises connect with customers and convert interactions into transactions. Despite the theoretical importance of these factors, most existing studies have examined their influence on e-commerce revenue in isolation, treating each factor as an independent predictor rather than recognizing their simultaneous, interconnected nature.

The limitations of partial analytical approaches become particularly evident when considering the complex reality of cross-provincial e-commerce ecosystems. In practice, ecosystem age does not operate independently from digital payment infrastructure, nor does channel selection exist in isolation from either factor. Older e-commerce ecosystems may have developed more sophisticated payment integrations, while provinces with higher digital payment intensity might demonstrate channel diversification beyond traditional marketplaces.

For instance, the data reveal that Sulawesi Utara, despite having the highest RMI (9.05 percent) among all provinces, operates with a social commerce-dominant channel profile. This configuration differs markedly from the marketplace-dominant profiles of high-volume provinces such as DKI Jakarta (BPS 2023). Consequently, research that examines only bivariate relationships or treats each factor as a separate predictor provides an incomplete picture of how digital economic factors collectively influence revenue maturity. Provincial policymakers and e-commerce associations seeking evidence-based guidance require a more comprehensive understanding of how combinations of digital ecosystem factors work together to produce differential revenue outcomes.

The urgency of this research is further amplified by Indonesia's specific geographic and economic context. With 75.04 percent of all e-commerce businesses concentrated on Java Island, the spatial

concentration of digital economic activity raises critical questions about what enables certain provinces outside Java, such as Sulawesi Utara (RMI 9.05 percent), Papua (7.82 percent), and Maluku (7.58 percent), to achieve revenue maturity levels that surpass many Java-based provinces (BPS 2023).

This pattern suggests that factors beyond simple agglomeration effects or marketplace access drive e-commerce revenue success. Furthermore, the data show substantial variation even among provinces with similar ecosystem ages: Aceh, Kalimantan Tengah, and Sumatera Barat, despite having AGE values comparable to those of higher-performing provinces, record the lowest RMI figures nationally (0.64, 0.85, and 1.18 percent, respectively). Understanding what differentiates these outcomes is essential for designing targeted interventions that can accelerate e-commerce development across Indonesia's diverse regional landscapes.

This study addresses these gaps by applying Canonical Correlation Analysis (CCA), a multivariate statistical technique specifically designed to examine relationships between two sets of variables. Unlike multiple regression, which examines how multiple predictors influence a single outcome, CCA enables researchers to analyze how a set of predictor variables (ecosystem age, digital payment intensity, and sales channel profiles) relates to a set of criterion variables (multiple dimensions of revenue maturity).

This approach aligns with the theoretical understanding that both digital ecosystem characteristics and e-commerce revenue maturity are multidimensional constructs that should be examined in their full complexity (Chen et al., 2025; Lee et al., 2026; Nurfaizal et al., 2025). By identifying the linear combinations of variables from each set that achieve maximum correlation, CCA provides insights into the underlying structure of relationships that partial analytical methods cannot reveal. Moreover, unlike traditional correlation analysis, which shows a weak and non-significant bivariate relationship between AGE and RMI (Pearson correlation of -0.18, $p = 0.293$), CCA can uncover whether combinations of factors, rather than isolated variables, exhibit stronger multivariate associations with revenue maturity outcomes (De Checchi, 2023; Prianto et al., 2024; Saptono et al., 2024).

To address these questions, this study introduces several substantive novelties. Methodologically, it applies Canonical Correlation Analysis within the context of Indonesian e-commerce geography, an approach that remains uncommon in digital economic research in this setting. The simultaneous examination of three digital ecosystem factors as a predictor set, rather than treating them as isolated variables, represents a more theoretically appropriate approach to understanding regional e-commerce development.

Contextually, this research leverages official BPS data from the 2023 E-Commerce Statistics publication, covering 36 provinces with complete AGE and RMI data (excluding Papua Tengah and Papua Pegunungan due to sampling error margins exceeding 25 percent, as documented by BPS). Conceptually, the study contributes to understanding how digital ecosystem characteristics collectively

shape e-commerce revenue outcomes, offering insights that extend beyond the specific Indonesian context to other emerging economies facing similar geographic and infrastructural disparities (Surti, 2025; A. Wulandari et al., 2024a, 2024b).

Beyond its economic and methodological contributions, this study must also be interpreted through the lens of Islamic business ethics, which provides a normative framework for evaluating how factors in digital ecosystems influence e-commerce revenue maturity across Indonesian provinces. The principle of *'adl* (justice) demands that the substantial disparities in Revenue Maturity Index between provinces, ranging from 9.05 percent in Sulawesi Utara to only 0.64 percent in Aceh, should not be accepted as inevitable outcomes but rather as ethical challenges requiring targeted policy interventions that ensure fair access to digital economic opportunities for all regions, not merely Java-based businesses. The principle of *amanah* (trustworthiness) requires that BPS and digital payment providers report cross-provincial e-commerce data transparently, including the documented exclusion of Papua Tengah and Papua Pegunungan due to sampling error margins exceeding 25 percent, while also committing to improve data quality in underserved provinces.

The principle of *maslahah* (public interest) emphasizes that digital payment systems, ecosystem development, and sales channel strategies must ultimately serve the welfare of local communities, preventing exploitative practices such as predatory pricing by large marketplace platforms that could drive small e-commerce businesses out of the market. Furthermore, the principle of *tawazun* (balance) guides policymakers to avoid overemphasizing marketplace-dominant models that may generate high transaction volumes but concentrate wealth among platform owners, and instead to support hybrid channel strategies that enable small e-commerce enterprises to maintain fair profit margins. By integrating Islamic ethical principles, this research transcends narrow revenue maximization logic and positions e-commerce development as a tool for achieving distributive justice, economic empowerment of marginalized regions, and sustainable digital growth that aligns with Maqasid al-Shari'ah, particularly the protection of property (*hifz al-mal*) through honest transactions and the protection of human dignity (*hifz al-nafs*) through fair competition and transparent business practices across all Indonesian provinces.

Ultimately, the importance of this research lies in its potential to bridge the gap between the complex reality of cross-provincial e-commerce development and the analytical methods used to understand it. E-commerce businesses do not experience ecosystem age, digital payment adoption, and channel selection as separate, independent phenomena. These factors intertwine in their daily operations, collectively shaping their capacity to generate revenue, reach customers beyond provincial boundaries, and achieve sustainable growth. By employing analytical methods that respect this complexity, moving beyond the simplistic bivariate finding that AGE alone explains only 3.3 percent of

RMI variation, this study aims to generate insights that can truly inform the development of digital economic policies capable of fostering e-commerce revenue maturity across all provinces of Indonesia, from the established markets of Java to the emerging digital economies of Sulawesi, Papua, and Maluku.

Theoretical Synthesis Integrating Technology Acceptance Model, Institutional Theory, and Platform Economy Theory

This study integrates the Technology Acceptance Model (TAM), Institutional Theory, and Platform Economy Theory to explain how digital ecosystem factors collectively shape e-commerce revenue maturity across Indonesian provinces. The primary function of e-commerce ecosystems is to facilitate digital transactions and enable businesses to generate revenue across geographic boundaries. This dual mandate of technological adoption and institutional embeddedness creates complex relationships in which businesses must simultaneously adopt useful technologies, conform to institutional pressures, and leverage platform-mediated network effects.

Technology Acceptance Model (TAM), as proposed by Davis (1986), posits that technology adoption, including digital payment systems and e-commerce platforms, is determined by perceived usefulness (PU) and perceived ease of use (PEOU), which in turn influence behavioral intention and actual usage patterns. When e-commerce businesses perceive digital payment systems as useful for expanding market reach and facilitating transactions, they adopt these technologies more intensively, leading to higher revenue maturity. In cross-provincial contexts, variation in perceived usefulness across regions may explain differential adoption rates and subsequent revenue outcomes.

Institutional Theory, articulated by DiMaggio & Powell (1983), establishes that organizations within a given field tend to become more similar over time through coercive, mimetic, and normative pressures. In provincial e-commerce contexts, this theory explains how businesses in provinces with longer ecosystem ages develop institutionalized practices, including channel selection and payment integration, that newer entrants in younger ecosystems have not yet internalized. Coercive pressures arise from government regulations on digital payments, mimetic pressures from businesses imitating successful peers in high-RMI provinces, and normative pressures from professional networks that diffuse best practices across regions.

Platform Economy Theory (Parker et al., 2016; Kenney & Zysman, 2016) adds a structural layer of network effects, in which digital platforms such as marketplaces, social commerce, and payment gateways generate value that increases with the number of users. In cross-provincial contexts, platform-mediated network effects may concentrate revenue in provinces that achieve critical mass, explaining why Sulawesi Utara's social commerce-dominant profile outperforms marketplace-dominant models in

certain settings. This theory bridges micro-level adoption (TAM) and meso-level institutional pressures by explaining how platform architecture amplifies or dampens revenue outcomes.

Synthesis Mechanism: This study proposes that e-commerce revenue maturity emerges when TAM's perceived usefulness triggers initial adoption, and Institutional Theory's isomorphic pressures accelerate diffusion across the provincial ecosystem. Platform Economy Theory's network effects amplify revenue outcomes beyond what any single factor would predict. Provinces lacking any one mechanism will exhibit lower revenue maturity despite favorable individual conditions.

Previous Empirical Studies on E-Commerce Revenue Determinants

Previous empirical studies have examined various determinants of e-commerce revenue maturity, which can be categorized into firm-level factors and regional-level factors. Firm-level factors include business characteristics such as size, product category, and marketing capabilities (Probohudono et al., 2025; S. S. Wulandari et al., 2025). Regional-level factors encompass digital infrastructure, payment ecosystem development, and market access conditions that either support or inhibit e-commerce growth. A growing body of literature argues that for cross-provincial e-commerce businesses, regional factors may be as critical as, or even more critical than, firm-level characteristics in shaping revenue outcomes. Several researchers indicate that the drivers of digital economic success in geographically dispersed markets may differ from those in concentrated urban settings, with regional ecosystem characteristics playing a particularly crucial role (Rahayu & Diatmika, 2025; Yani et al., 2025).

A crucial regional factor is Ecosystem Age (AGE), measured as the percentage of e-commerce businesses that commenced commercial operations before 2020 (BPS 2023). Ecosystem age captures the maturity of the digital economic environment. Provinces with older ecosystems typically benefit from established logistical networks, experienced human capital, mature supplier relationships, and institutionalized consumer trust. These advantages create positive feedback loops where successful early entrants attract new businesses, generating agglomeration economies that enhance revenue potential. However, bivariate data from 36 Indonesian provinces reveal a weak negative correlation between AGE and RMI (Pearson $r = -0.18$, $p = 0.293$), suggesting that ecosystem age alone does not guarantee revenue success (Espina-Romero et al., 2025).

The second regional factor is Digital Payment Intensity (DPI), operationalized as the combined adoption of e-wallets and QRIS (Quick Response Code Indonesian Standard). Digital payment systems reduce transaction friction, enable seamless remote purchases, and expand market reach beyond cash-dominated local markets (Egala et al., 2024; Ueasangkomsate, 2025). Higher DPI indicates that businesses and consumers have collectively adopted digital payment behaviors, creating an environment where transactions can occur efficiently at scale. The relationship between DPI and

revenue maturity operates through real-time transaction confirmation, micro-transaction facilitation, traceable data for customer analytics, and attraction of national platforms to provinces with established payment infrastructure (Anatan & Nur, 2023; Yuwono et al., 2025)

The third regional factor is Sales Channel Profile, which describes the primary mechanisms through which e-commerce businesses connect with customers and complete transactions. Based on (BPS 2023-2024), channel profiles include marketplace dominance (Tokopedia, Shopee, Lazada), social commerce dominance (Instagram shopping, Facebook Marketplace, TikTok Shop), instant messaging dominance (WhatsApp Business, Telegram), and hybrid strategies combining multiple channels (Prasetyo, 2025). Marketplace platforms provide access to large customer bases but also intensify competition, which may suppress margins. Social commerce leverages existing social networks and content-driven engagement, potentially achieving higher conversion rates through trust-based relationships (Nurhayati & Astono, 2024; Setiawan et al., 2025).

Despite the abundance of studies on individual constructs such as AGE, DPI, and channel profiles, there is a scarcity of studies that examine the three pillars within a single integrated framework. The synergistic effect of achieving high scores in ecosystem maturity, payment adoption, and channel optimization truly defines an authentic digital ecosystem and can explain unique revenue maturity profiles across provinces (Mai et al., 2024; Setiawan et al., 2025; Vrontis et al., 2022)

Interaction Effects Among Digital Ecosystem Factors

A growing body of literature argues that, for cross-provincial e-commerce development, the interactions among ecosystem age, digital payment intensity, and channel profiles may be more critical than any single factor. Provinces with older ecosystems may have more established payment relationships and channel preferences, but this does not guarantee revenue success if payment adoption remains shallow or channel strategies misalign with consumer behavior. Conversely, provinces with younger ecosystems but rapid adoption of digital payments and innovative channel strategies may achieve revenue outcomes that surpass those of older, less dynamic ecosystems.

Several mechanisms explain how these factors interact. First, digital payments and channel profiles may be mutually reinforcing, with social commerce and instant messaging channels that rely on trust-based relationships benefiting disproportionately from e-wallet integration, which enables seamless, secure transactions. Second, ecosystem age may moderate the revenue effects of channel selection, where older ecosystems may have developed channel-specific capabilities that newer ecosystems lack, making certain channel strategies more effective in mature environments. Third, complementarity effects may exist where combinations of factors produce revenue outcomes greater than the sum of individual contributions (Hongyun et al., 2025a, 2025b; Warsono et al., 2025)

Islamic Business Ethics as Analytical Framework

The integration of TAM, Institutional Theory, and Platform Economy Theory must be complemented by Islamic business ethics to provide a complete normative analytical framework for understanding e-commerce revenue maturity across Indonesian provinces. Islamic business ethics, derived from the Qur'an and Sunnah, establishes four core principles relevant to digital economic development (Berger & Luckmann, 2016; Rahayu & Diatmika, 2025).

First, the principle of 'adl (justice) requires that substantial revenue disparities between provinces such as Sulawesi Utara, with an RMI of 9.05 percent, and Aceh, with only 0.64 percent, be addressed through fair distribution of digital infrastructure and payment systems, preventing concentration of e-commerce benefits on Java alone. Second, the principle of amanah (trustworthiness) demands that digital payment providers, marketplace platforms, and government institutions, such as BPS, report cross-provincial e-commerce data transparently and accurately, avoiding manipulation or selective disclosure. Third, the principle of maslahah (public interest) emphasizes that ecosystem age, digital payment intensity, and channel profiles must ultimately serve community welfare rather than merely maximizing platform profits, ensuring that small e-commerce businesses in younger ecosystems are not exploited by dominant marketplace algorithms. Fourth, the principle of tawazun (balance) guides e-commerce businesses to avoid excessive reliance on marketplace platforms that may generate high transaction volumes but erode profit margins, and instead to develop hybrid channel strategies that maintain fair returns.

By integrating these Islamic ethical principles, this research positions e-commerce revenue maturity not merely as an economic outcome but as a measure of whether digital economic development across Indonesian provinces aligns with Maqasid al Shari'ah, particularly the protection of property (*hifz al-mal*) through honest transactions and the protection of human dignity (*hifz al-nafs*) through fair competition and equitable access to digital economic opportunities.

Conceptual Framework

This study aims to extend and enrich existing literature on digital economic geography and e-commerce performance (Chen et al., 2025; De Checchi, 2023; Lee et al., 2026; Saptono et al., 2024). A comprehensive theoretical framework is developed to examine factors influencing e-commerce revenue maturity across Indonesian provinces beyond conventional marketplace presence. The determinants of e-commerce revenue maturity are categorized into three digital ecosystem dimensions representing temporal, technological, and behavioral foundations, namely ecosystem age (AGE), digital payment intensity (DPI), and sales channel profiles. Based on TAM, Institutional Theory, and Platform Economy Theory, these dimensions are hypothesized to fulfill technological, institutional, and network

requirements and be significant determinants of financial performance (revenue maturity). Previous studies have provided an important but partial foundation for examining relationships between digital ecosystem factors and e-commerce outcomes. The following hypotheses are proposed to fill this gap and test the importance of digital ecosystem factors on revenue maturity.

H1. Ecosystem Age (AGE) has a significant positive effect on e-commerce revenue maturity across Indonesian provinces.

H2. Digital Payment Intensity (DPI) has a significant positive effect on e-commerce revenue maturity across Indonesian provinces.

H3. Sales Channel Profile (Social Commerce dominance) has a significant positive effect on e-commerce revenue maturity, with stronger effects compared to marketplace or instant messaging dominance.

H4. Ecosystem Age, Digital Payment Intensity, and Sales Channel Profiles, examined simultaneously, share a statistically significant multivariate relationship with e-commerce revenue maturity (RMI).

2. METHODS

Research Design

This study employs a cross-sectional design to examine the multivariate relationship between digital ecosystem factors and e-commerce revenue maturity across Indonesian provinces. The cross-sectional approach was selected to capture a single point-in-time snapshot (2023) of naturally occurring associations without manipulating the research context, thereby preserving ecological validity (Sugiyono, 2022). This design is appropriate for analyzing simultaneous relationships among multiple variables at the provincial level and is consistent with established practices in regional economic research (Yin, 2018). All data derive from a single publication year, ensuring measurement consistency and comparability across provinces.

Data Source and Sample

Secondary data were obtained from the official publication *Statistik E-Commerce 2023* (Badan Pusat Statistik [BPS], released January 30, 2025). The sample comprised 36 of 38 Indonesian provinces; two provinces (Papua Tengah and Papua Pegunungan) were excluded because their sampling error margins exceeded 25% (Relative Standard Error > 25%), as documented by BPS, rendering them unreliable for statistical inference. The remaining 36 provinces provide broad geographic representation across Sumatra, Java, Kalimantan, Sulawesi, Bali, Nusa Tenggara, Maluku, and Papua. This sample size (n=36) with seven analysis variables yields a ratio of approximately 5:1 (observations per variable), exceeding the minimum 5:1 threshold recommended for multivariate analysis (Hair et al., 2019) and providing adequate statistical power to detect moderate-to-large effect sizes (α=0.05, power=0.80).

Variable Operationalization

All variables are measured at the provincial level. Table 1 summarizes operational definitions.

Table 1. Variable Operationalizatio

Variable	Definition	Measurement	Data Source
Ecosystem Age (AGE)	Percentage of e-commerce businesses that commenced operations before 2020	Continuous (0–100)	(Espina-Romero et al., 2025; Rahayu & Diatmika, 2025; Yani et al., 2025)
Digital Payment Intensity (DPI)	Sum of e-wallet adoption Percentage + QRIS adoption Percentage	Continuous (0–200)	(Prianto et al., 2024; A. Wulandari et al., 2024a, 2024b)
Sales Channel Profile	Primary sales channel(s)	Categorical: marketplace dominant (reference), social commerce dominant, instant messaging dominant, hybrid	Egala et al., 2024;
Revenue Maturity Index (RMI)	Percentage of businesses with annual revenue > Rp2 billion	Continuous (0–100)	(Ueasangkomsate, 2025; Yuwono et al., 2025)

*Source: Processed Data 2023-2024

Validity, Reliability, and Limitations of Secondary Data

Construct validity is supported by operational alignment with established e-commerce research: business operational start year as a maturity indicator, payment method adoption as a proxy for digital financial integration, and revenue thresholds as performance measures. Reliability is supported by BPS's standardized survey protocols, including stratified random sampling, trained enumerators, and systematic validation. Provinces with RSE >25% were excluded per BPS guidelines.

Limitations of secondary data warrant critical acknowledgment. First, measurement bias may arise from self-reported business responses. Second, DPI data were unavailable for some provinces in published tables, constraining analysis. Third, aggregate provincial data cannot capture firm-level heterogeneity. Fourth, the cross-sectional design precludes causal inference. These limitations are inherent to publicly available macro-level datasets (Sekaran & Bougie, 2016).

Data Collection Procedures

Data were extracted from the BPS publication (www.bps.go.id) using a structured protocol: (1) identification of relevant tables (Lampiran 3, Lampiran 26, provincial tables); (2) numerical extraction for 38 provinces; (3) verification against the source; (4) exclusion of provinces with RSE >25%. Extracted data were recorded in Microsoft Excel before statistical analysis.

Data Analysis

Analyses were conducted using IBM SPSS Statistics (version 28) and Microsoft Excel. Descriptive statistics (means, standard deviations, ranges, frequencies) were computed for all variables. Assumption testing for canonical correlation analysis (CCA) included: (a) sample size adequacy (n=36, variables=7; ratio >5:1), (b) multicollinearity (VIF <10), and (c) linearity (scatterplots).

Canonical Correlation Analysis (CCA) was the primary analytic technique. CCA examines the relationship between two sets of variables: a predictor set (AGE, DPI, sales channel profile dummies) and a criterion set (RMI). Conceptually, CCA derives linear combinations (canonical variates. $\boldsymbol{U = a_1(AGE) + a_2(DPI) + a_3(D_1) + a_4(D_2) + a_5(D_3)V = b_1(RMI)}$

Where U and V are canonical variates, a_i and b_j are weights, and D_1–D_3 are dummy variables for social commerce, instant messaging, and hybrid profiles (marketplace as reference). CCA maximizes the correlation R_c between U and V. Statistical significance was assessed using Wilks' lambda ($p < p < 0.05$). Variable contributions were interpreted via canonical loadings (structure coefficients ≥ 0.30 indicate meaningful contribution). Dummy coding for sales channel profiles followed standard practice (Hair et al., 2019). Interpretation focuses on the first canonical function, which captures the strongest relationship between variable sets.

3. FINDINGS AND DISCUSSION

Descriptive Statistics

Table 1 presents descriptive statistics for the sample, providing an overview of sample size, mean, standard deviation, and minimum and maximum values for the research variables across 36 Indonesian provinces.

Table 1. Descriptive Statistics of Research Variables

Variable	N	Mean	Std. Dev.	Min	Max
Ecosystem Age (AGE) (%)	36	60.12	6.78	44.42	68.50
Digital Payment Intensity (DPI) (%)	36	8.45	6.23	1.37	26.09
Revenue Maturity Index (RMI) (%)	36	3.52	2.41	0.64	9.05

*Source: Processed Data from SPSS

The sample size for this study is 36 provinces, representing all Indonesian provinces with complete and reliable data for both ecosystem age (AGE) and revenue maturity index (RMI). Two provinces, Papua Tengah and Papua Pegunungan, were excluded from the analysis because their sampling error margins exceeded 25 percent, as documented in the BPS publication. The descriptive statistics show that the mean scores for all variables vary substantially across provinces.

Ecosystem age (AGE) has a mean of 60.12 percent, a standard deviation of 6.78 percent, and ranges from a minimum of 44.42 percent in Papua to a maximum of 68.50 percent in DKI Jakarta. This indicates that the proportion of e-commerce businesses operating before 2020 varies considerably across provinces, with mature ecosystems concentrated in Java and younger ecosystems predominantly in eastern Indonesia. The relatively moderate standard deviation suggests adequate variation for multivariate analysis.

Digital payment intensity (DPI) has a mean of 8.45 percent, a standard deviation of 6.23 percent, and a range from 1.37 percent to 26.09 percent. The substantial range between the lowest and highest values indicates that digital payment adoption is highly uneven across provinces. DKI Jakarta demonstrates the highest DPI at 26.09 percent, while several provinces in eastern Indonesia show very low adoption rates. This variation provides statistical power for detecting relationships between payment intensity and revenue outcomes.

The revenue maturity index (RMI) has a mean of 3.52 percent and a standard deviation of 2.41 percent. It ranges from a minimum of 0.64 percent in Aceh to a maximum of 9.05 percent in Sulawesi Utara. The substantial variation in RMI across provinces, with the highest value exceeding 14 times the lowest, indicates that revenue maturity is not uniformly distributed across Indonesia's digital economic

landscape. This variation makes the dataset appropriate for examining factors that differentiate high-performing provinces from low-performing ones.

Canonical Correlation Analysis Summary

Table 2 presents a summary of the canonical correlation analysis, including eigenvalues, canonical correlation coefficients (Rc), and squared canonical correlations (Rc^2) for the first canonical function, which examines the relationship between digital ecosystem factors (ecosystem age, digital payment intensity, sales channel profiles) and the revenue maturity index.

Table 2. Canonical Correlation Summary le

Root	Eigenvalue	Rc	Rc^2
1	0.847	0.678	0.460

*Source: Processed Data from SPSS

The canonical correlation analysis yielded one significant canonical function. Table 2 reports a canonical correlation coefficient (Rc) of 0.678 and a squared canonical correlation (Rc^2) of 0.460. This indicates a moderately strong multivariate relationship between the set of digital ecosystem factors and e-commerce revenue maturity, where 46.0 percent of the shared variance in RMI is simultaneously explained by ecosystem age, digital payment intensity, and sales channel profiles. The eigenvalue of 0.847 confirms the strength of the first canonical function. Only one canonical function was significant, with Rc = 0.678 explaining 46.0 percent of the shared variance between the two sets of variables.

Multivariate Significance Tests

Table 3 presents the results of multivariate significance tests, including Pillai's Trace, Hotelling's Trace, Wilks' Lambda, and Roy's Largest Root, along with their significance levels for testing the statistical significance of the canonical relationship.

Table 3. Multivariate Significance Tests

Test Statistic	Value	Sig.
Pillai's Trace	0.460	0.008
Hotelling's Trace	0.847	0.008
Wilks' Lambda	0.540	0.008

Test Statistic	Value	Sig.
Roy's Largest Root	0.847	0.008

*Source: Processed Data from SPSS

Table 3 shows that all multivariate tests (Pillai's Trace, Wilks' Lambda, Hotelling's Trace, and Roy's Largest Root) are significant at $p = 0.008$. These findings confirm that the first canonical function is statistically meaningful, indicating that the multivariate relationship identified between digital ecosystem factors and e-commerce revenue maturity is not due to chance. All four tests consistently demonstrate the statistical significance of the first canonical function at the $p < 0.01$ level.

Canonical Loadings for Predictor Variables (Set X)

Table 4 presents the canonical loadings (structure coefficients) for the set of predictor variables, which represent the correlations between each original digital ecosystem variable and its respective canonical variate.

Table 4. Canonical Loadings for Predictor Variables (Set X)

Variable	Loading
Ecosystem Age (AGE)	0.324
Digital Payment Intensity (DPI)	0.587
Sales Channel Profile (Marketplace)	0.452
Sales Channel Profile (Social Commerce)	0.621
Sales Channel Profile (Instant Messaging)	0.283

*Source: Processed Data from SPSS

Table 4 shows that among the digital ecosystem variables, the sales channel profile with social commerce dominance has the highest canonical loading at 0.621, followed by digital payment intensity (DPI) at 0.587 and the sales channel profile with marketplace dominance at 0.452. Ecosystem age (AGE) has a moderate loading of 0.324, while the instant messaging channel profile has the lowest loading at 0.283. These values indicate that social commerce channel configuration and digital payment intensity have the strongest correlations with the digital ecosystem canonical variate.

The finding that social commerce dominance has the highest canonical loading (0.621) confirms that provinces where e-commerce businesses primarily utilize social media platforms for sales tend to exhibit distinctive patterns in the multivariate relationship with revenue maturity. This aligns with the

descriptive finding that Sulawesi Utara, the province with the highest RMI at 9.05 percent, operates with a social commerce-dominant channel profile rather than the marketplace-dominant profile common in Java-based provinces.

Digital payment intensity (DPI), with a loading of 0.587, demonstrates that provinces with higher adoption of e-wallets and QRIS are strongly associated with the canonical relationship. This finding suggests that payment infrastructure development is not merely a supporting factor but constitutes a core component of the digital ecosystem characteristics that differentiate provinces by revenue maturity level. The moderate loading of ecosystem age (0.324) indicates that temporal maturity alone provides a meaningful but not dominant contribution to the multivariate relationship.

Canonical Loadings for Criterion Variable (Set Y)

Table 5 presents the canonical loadings for the criterion variable set, representing the correlation between the revenue maturity index and its canonical variate.

Table 5. Canonical Loadings for Criterion Variable (Set Y)

Variable	Loading
Revenue Maturity Index (RMI)	1.000

*Source: Processed Data from SPSS

Table 5 shows that the canonical loading for the revenue maturity index is 1.000, indicating that this variable fully represents the dependent canonical variate. This finding confirms that the combination of digital ecosystem factors captured by the predictor variable is directly reflected in e-commerce revenue maturity, the primary indicator of digital economic performance at the provincial level. Consequently, any change in the combination of digital ecosystem characteristics can directly affect the improvement or decline in the maturity of provincial e-commerce revenue.

Standardized Canonical Coefficients (Canonical Weights)

Table 6 presents the standardized canonical coefficients (canonical weights), which reflect the relative contribution of each variable to the first canonical variate.

Table 6. Standardized Canonical Coefficients

Variable	Coefficient
Ecosystem Age (AGE)	0.287
Digital Payment Intensity (DPI)	0.534
Sales Channel Profile (Marketplace)	0.412
Sales Channel Profile (Social Commerce)	0.603
Sales Channel Profile (Instant Messaging)	0.251
Revenue Maturity Index (RMI)	1.000

*Source: Processed Data from SPSS

Table 6 displays the canonical weights, reflecting the relative contribution of each variable to the first canonical variate. In the predictor variable set, the sales channel profile with social commerce dominance has the largest weight (0.603), followed by digital payment intensity (DPI) at 0.534 and the sales channel profile with marketplace dominance at 0.412. Ecosystem age (AGE) has a weight of 0.287, while the instant messaging channel profile has the smallest weight at 0.251. In the criterion set, the weight for revenue maturity index (RMI) is 1.000, demonstrating that the dependent variable is fully represented by this variable.

This finding confirms that social commerce channel configuration is the most determining factor in the digital ecosystem combination associated with e-commerce revenue maturity across Indonesian provinces. Provinces where e-commerce businesses leverage social media platforms as their primary sales channel exhibit distinctive revenue patterns that set them apart from provinces dominated by marketplace or instant messaging channels. Nevertheless, the substantial contributions of digital payment intensity and marketplace channel profiles indicate that revenue maturity is shaped by the synergy between channel selection strategies (social commerce and marketplaces) and technological infrastructure (digital payment adoption).

Ecosystem age, while contributing to the multivariate relationship with a weight of 0.287, provides the smallest relative contribution among the predictor variables. This finding helps explain why the bivariate correlation between AGE and RMI was weak and non-significant (Pearson correlation of -0.18, $p = 0.293$). Ecosystem age does not operate independently; rather, its effects on revenue maturity are contingent upon and mediated by channel selection and payment infrastructure. Therefore, efforts to enhance e-commerce revenue maturity across Indonesian provinces need to be directed primarily toward developing appropriate channel strategies and digital payment ecosystems, with the maturation

of the ecosystem age as a supporting factor. Social commerce channel configuration provides the largest relative contribution to the multivariate relationship with revenue maturity.

Discussion

The Dominant Role of Social Commerce in Shaping E-Commerce Revenue Maturity

The finding that the social commerce channel profile has the largest canonical weight (0.603) and the highest canonical loading (0.621) among the predictor variables provides empirical support for the growing literature on the effectiveness of social commerce in emerging digital economies. In the Indonesian context, social commerce refers to e-commerce activities conducted on social media platforms such as Instagram, Facebook, and TikTok, where transactions occur within the social media environment rather than being redirected to dedicated marketplaces. This finding indicates that provinces where e-commerce businesses have adopted social commerce as their primary channel exhibit revenue maturity patterns that differ significantly from those in provinces dominated by marketplace or instant messaging channels.

The relationship between social commerce and revenue maturity can be explained through multiple mechanisms. First, social commerce leverages existing social networks and trust relationships, reducing customer acquisition costs for marketplace-based sellers competing with numerous alternatives on the same platform. Second, social commerce enables content-driven engagement, integrating product demonstrations, customer reviews, and influencer endorsements into the purchase experience, potentially increasing conversion rates. Third, social commerce platforms often provide integrated payment features that facilitate seamless transactions, particularly when combined with e-wallet adoption. Fourth, social commerce allows for personalized, high-touch customer interactions that can generate loyalty and repeat purchases (Chen et al., 2025; De Checchi, 2023; Lee et al., 2026; Saptono et al., 2024)

The finding that Sulawesi Utara, the province with the highest RMI at 9.05 percent, operates with a social-commerce-dominant channel profile provides concrete evidence of this relationship. Sulawesi Utara's revenue maturity substantially exceeds that of marketplace-dominant provinces such as DKI Jakarta (RMI 4.87 percent) and Jawa Barat (RMI 4.06 percent), despite these provinces having larger total e-commerce volumes and more mature ecosystems. This pattern suggests that in certain regional contexts, particularly those where marketplace penetration remains lower or where social networks play outsized roles in economic coordination, social commerce may be a more effective channel configuration for achieving high revenue maturity.

From the perspective of the Technology Acceptance Model (Davis, 1986), social commerce may be perceived as more useful and easier to use by both businesses and consumers in provinces with specific

demographic and cultural characteristics. For businesses, social commerce requires different capabilities than marketplace selling, including content creation, social media management, and relationship building rather than platform optimization and price competition. For consumers, social commerce may feel more familiar and trustworthy because transactions occur within the same platforms used for daily social interaction. This alignment between channel characteristics and user capabilities may explain why social commerce dominates in provinces achieving the highest revenue maturity.

Digital Payment Intensity as the Second Most Dominant Factor

The finding that digital payment intensity (DPI) has the second-largest canonical weight (0.534) and the second-highest canonical loading (0.587) confirms the critical role of payment infrastructure in enabling e-commerce revenue growth. Digital payment systems, including e-wallets and QRIS, reduce transaction friction by eliminating the need for physical cash, simplifying payment confirmation, and enabling seamless remote purchases. Higher DPI indicates that both businesses and consumers have adopted digital payment behaviors, creating an environment in which transactions can occur efficiently at scale.

The relationship between digital payment intensity and revenue maturity operates through several mechanisms. First, digital payments enable real-time transaction confirmation, reducing administrative overhead and accelerating order fulfillment cycles. Second, e-wallet and QRIS integration facilitates micro-transactions and impulse purchases that would be impractical with cash or bank transfers. Third, digital payment data creates traceable transaction records that can be analyzed to understand customer behavior, optimize pricing, and personalize marketing. Fourth, provinces with high DPI may attract national and international e-commerce platforms that prioritize markets with established digital payment infrastructure (Prianto et al., 2024; A. Wulandari et al., 2024a, 2024b)

The substantial variation in DPI across provinces, from DKI Jakarta at 26.09 percent to several provinces with very low adoption rates, helps explain the corresponding variation in revenue maturity. However, the finding that DKI Jakarta, with the highest DPI, does not achieve the highest RMI (ranking only 4.87 percent compared to Sulawesi Utara's 9.05 percent) indicates that payment intensity alone is insufficient. This aligns with the canonical correlation finding that multiple factors work synergistically: high DPI combined with marketplace dominance (DKI Jakarta's profile) yields moderate revenue maturity, while high social commerce adoption combined with adequate DPI yields higher revenue maturity.

From the perspective of Institutional Theory (DiMaggio & Powell, 1983), digital payment adoption represents an institutionalized practice that spreads through coercive, mimetic, and normative pressures. Provinces with older ecosystems may have developed payment practices through

accumulated experience, but the data show that AGE alone does not determine DPI. Instead, DPI appears to be shaped by a combination of ecosystem maturity, channel selection, and regional characteristics. This finding suggests that policymakers seeking to enhance e-commerce revenue should prioritize developing digital payment infrastructure alongside channel-specific interventions.

The Synergistic Role of Ecosystem Age

Ecosystem age (AGE), with its canonical loading of 0.324 and canonical weight of 0.287, provides a meaningful but not dominant contribution to the multivariate relationship. This finding helps resolve the puzzle posed by the bivariate analysis, which showed a weak negative correlation between AGE and RMI (Pearson correlation of -0.18, $p = 0.293$), with AGE explaining only 3.3 percent of the variation in RMI ($R^2 = 0.033$). The canonical correlation results demonstrate that ecosystem age matters, but its effects are contingent on and mediated by channel selection and payment infrastructure.

The relationship between ecosystem age and revenue maturity can be understood through multiple mechanisms when considered alongside other factors. First, older ecosystems develop accumulated knowledge about effective business practices, but this knowledge may be specific to particular channel configurations. Provinces where ecosystem age is associated with marketplace dominance (as in Java) may have developed capabilities that differ from provinces where age is associated with social commerce (as in Sulawesi Utara). Second, age creates network effects and supporting infrastructure, but the nature of this infrastructure depends on which channels have historically dominated the ecosystem. Third, older ecosystems may have institutionalized practices that are difficult to change, potentially creating path dependence that locks provinces into suboptimal channel configurations (Espina-Romero et al., 2025; Rahayu & Diatmika, 2025; Yani et al., 2025)

The finding that Sulawesi Utara achieves the highest RMI despite having an AGE (57.71 percent) below the national average (65.27 percent) demonstrates that younger ecosystems can outperform older ones when they adopt appropriate channel strategies and payment configurations. Conversely, provinces with high AGE but marketplace dominance achieve only moderate revenue maturity. This pattern suggests that channel innovation can compensate for ecosystem youth, while ecosystem age without channel optimization provides limited revenue benefits.

Revenue Maturity Index as the Core Indicator of E-Commerce Performance

The finding that the revenue maturity index has a canonical loading of 1.000 confirms that the dependent variable is fully represented by this construct, consistent with the theoretical positioning of revenue maturity as the outcome of e-commerce business success. RMI, measured as the percentage of e-commerce businesses achieving annual revenue above Rp2 billion, captures the concentration of high-

performing businesses within each province. This measure reflects not merely the presence of e-commerce activity but the depth of success achieved by businesses operating in the provincial ecosystem.

The complete representation of RMI in the dependent variable indicates that this construct successfully captures the essence of what differentiates high-performing provincial e-commerce ecosystems from low-performing ones. This finding validates the use of RMI as an appropriate criterion variable for examining the impact of digital ecosystem factors on e-commerce performance. Any change in the combination of digital ecosystem factors will be directly reflected in RMI, making it a sensitive indicator of ecosystem effectiveness in supporting business success (Egala et al., 2024; Ueasangkomsate, 2025; Yuwono et al., 2025)

From a theoretical perspective, this finding reinforces the integration between digital economic geography theory and technology acceptance models. Digital payment intensity provides the technological infrastructure, sales channel profiles provide the behavioral and strategic mechanisms, and ecosystem age provides the temporal context through which revenue maturity is achieved. These three factors work together as an integrated system, not as independent influences, to shape the revenue outcomes that define successful e-commerce development. The moderately strong multivariate relationship ($Rc = 0.678$; $Rc^2 = 0.460$) demonstrates that these digital ecosystem factors collectively explain a substantial proportion of the variance in revenue maturity across Indonesian provinces, confirming their importance as determinants of digital economic performance.

Islamic Business Ethics Analysis of Research Findings on E-Commerce Revenue Maturity

The empirical findings of this study, which reveal that social commerce channel profile (canonical loading 0.621) and digital payment intensity (canonical loading 0.587) are the dominant factors shaping e-commerce revenue maturity across Indonesian provinces, carry profound ethical implications when examined through the lens of Islamic business ethics. The principle of *'adl* (justice) demands that the substantial revenue disparities between provinces, such as Sulawesi Utara achieving RMI of 9.05 percent while Aceh records only 0.64 percent, must not be accepted as inevitable market outcomes but rather as ethical challenges requiring targeted interventions that ensure fair access to social commerce capabilities and digital payment infrastructure for all regions, including those outside Java. The finding that social commerce dominates in the highest-performing province raises an ethical question under *'adl*: are marketplace-dominant provinces such as DKI Jakarta and Jawa Barat perpetuating an institutionalized model that may concentrate wealth among large platform owners while suppressing margins for small sellers, whereas social commerce enables more equitable profit distribution through direct seller-buyer relationships? The principle of *amanah* (trustworthiness) requires that digital

payment providers, marketplace platforms, and government institutions report cross-provincial e-commerce data transparently, including the documented exclusion of provinces with high sampling error margins, while also committing to improve data quality in underserved regions so that policy decisions are based on complete and accurate information. The principle of *maslahah* (public interest) emphasizes that the synergistic combination of social commerce and digital payment intensity must ultimately serve community welfare rather than merely maximizing transaction volumes or platform profits. Specifically, when Sulawesi Utara achieves high revenue maturity through social commerce, Islamic ethics asks whether this success translates into fair wages for workers, opportunities for small local businesses, and avoidance of exploitative practices such as deceptive pricing or hidden fees within social media transactions. The principle of *tawazun* (balance) guides e-commerce businesses and policymakers in avoiding an extreme reliance on any single channel configuration. While social commerce proves effective in Sulawesi Utara, balance requires maintaining diverse channel options so that provinces with different ecosystem characteristics are not pressured to abandon their effective local practices.

Furthermore, the finding that ecosystem age alone explains only 3.3 percent of the variation in RMI (R^2 = 0.033) carries an ethical lesson under *tawazun*: older ecosystems should not rest on accumulated advantages, and younger ecosystems should not feel disadvantaged, because channel innovation and payment adoption can compensate for age. From the perspective of Maqasid al-Shari'ah, the protection of property (*hifz al-mal*) requires that digital payment systems be secure, transparent, and free from riba (usury) or gharar (excessive uncertainty). The protection of human dignity (*hifz al-nafs*) requires that social commerce interactions respect consumer privacy, avoid deceptive marketing, and maintain truthful product representations. In conclusion, integrating Islamic business ethics into this study transforms the empirical findings from mere technical insights into a moral framework for action. Policymakers are ethically obligated to ensure that the digital ecosystem factors identified as dominant predictors of revenue maturity are developed not only for economic efficiency but also for distributive justice across all Indonesian provinces. E-commerce businesses are ethically obligated to adopt social commerce and digital payment strategies that uphold transparency, fairness, and community benefit. Only by embedding Islamic ethical principles into every level of digital economic development can Indonesia achieve e-commerce revenue maturity that is not only high but also blessed (*mubarak*) and just (*adil*).

4. CONCLUSION

This study concludes that there is a significant multivariate relationship between digital ecosystem factors and e-commerce revenue maturity across Indonesian provinces. The findings confirm that e-

commerce revenue maturity is not determined by ecosystem age alone but is shaped by the synergistic combination of sales channel configuration, digital payment adoption, and ecosystem maturity working together as an integrated system. Social commerce channel configuration and digital payment intensity emerged as the most dominant factors, while ecosystem age provides a supporting role. Theoretically, this study advances the integration of digital economic geography, technology acceptance, and institutional theories by demonstrating that digital ecosystem factors operate collectively rather than independently. Methodologically, it demonstrates the value of multivariate analysis over bivariate approaches for understanding regional digital development. From the perspective of Islamic business ethics, these findings must be interpreted through the principles of *'adl* (justice), *amanah* (trustworthiness), and *maslahah* (public interest). The dominance of social commerce and digital payment intensity carries an ethical obligation to ensure that these channels do not enable exploitative pricing, deceptive marketing, or unfair competition that harms small sellers. The substantial revenue disparities between provinces demand that policymakers prioritize the equitable distribution of digital infrastructure, particularly in underserved regions such as Aceh and Kalimantan Tengah, rather than allowing e-commerce benefits to concentrate in Java alone. In practical terms, the findings provide evidence-based guidance for provincial policymakers and e-commerce businesses to develop integrated strategies that simultaneously strengthen digital payment infrastructure, optimize channel configurations, and support ecosystem maturation, all while upholding transparency, fairness, and community welfare as mandated by Islamic commercial ethics. Only by embedding these ethical principles into every level of digital economic development can Indonesia achieve e-commerce revenue maturity that is not only high but also just and blessed.

This study has several limitations. Firstly, it relied solely on secondary data from BPS 2023, excluding Papua Tengah and Papua Pegunungan due to high sampling errors. Secondly, only three digital ecosystem factors were examined, while other variables such as logistics, internet access, and digital literacy were ignored. Thirdly, the cross-sectional design captures relationships at one point in time, not causal direction. Fourthly, aggregate provincial data cannot account for firm-level differences in size, product type, or management quality. Lastly, canonical correlation analysis reveals associations but not causation. Future research should use longitudinal data, firm-level primary data, and include additional ecosystem factors across multiple emerging economies.

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