

Integrating Technology Acceptance Model, Trust, and App Engagement

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ABSTRACT

The rapid growth of e-wallet adoption in Indonesia has intensified competition among providers, making customer loyalty increasingly difficult to maintain. This study investigates how data security, perceived ease of use, and perceived usefulness influence customer loyalty through user trust and app engagement. Drawing on the Technology Acceptance Model (TAM), trust theory, and engagement theory, data were collected from 233 active e-wallet users and analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM). The results show that all proposed relationships are significant. Data security is the strongest predictor of user trust ($\beta = 0.661$), outperforming perceived ease of use and perceived usefulness. User trust positively influences app engagement ($\beta = 0.570$), while app engagement has the strongest direct effect on customer loyalty ($\beta = 0.546$). Furthermore, app engagement partially mediates the relationship between trust and loyalty, accounting for 60.7% of the total effect. The findings suggest that loyalty in digital payment platforms is formed through a sequential process in which technology and security perceptions build trust, trust fosters engagement, and engagement strengthens loyalty. This study contributes to the literature by highlighting the central role of data security and app engagement in explaining loyalty formation in competitive digital payment environments.

INTRODUCTION

The rapid growth of financial technology (FinTech) has transformed Indonesia's payment landscape, establishing e-wallets as one of the most widely adopted digital payment instruments. Electronic money transactions exceeded IDR 700 trillion in 2024 (Bank Indonesia), and Indonesia has been identified as one of the fastest-growing e-wallet markets in Asia-Pacific, with adoption rates between 92% and 96% among digital consumers (Euromonitor International, 2023). Platforms such as GoPay, OVO, DANA, and ShopeePay have become integral to everyday transactions, including online purchases, bill payments, and peer-to-peer transfers. Despite this growth, high adoption rates do not necessarily translate into customer loyalty. Approximately 61% of users actively maintain two to three e-wallet

applications simultaneously to maximize promotional benefits and service features (InsightAsia, 2022; Populix, 2022). This multi-platform behavior is particularly evident in Greater Jakarta, highlighting a significant loyalty challenge in the digital payment ecosystem. This suggests that while data security, perceived ease of use (PEOU), and perceived usefulness (PU) as proposed by the Technology Acceptance Model (TAM) (Davis, 1989) may foster trust, they do not necessarily guarantee long-term user commitment.

Against this backdrop, this study examines the mediating role of app engagement in the relationship between user trust and customer loyalty among Indonesian e-wallet users, with trust shaped by three antecedents: data security, PEOU, and PU. Theoretically, although TAM has been widely applied to explain technology adoption and trust-based models have established the importance of security perceptions in shaping behavioral intentions (Gefen et al., 2003; Pavlou, 2003), loyalty formation at the post-adoption stage remains underexplored. Engagement theory suggests that cognitive, emotional, and behavioral engagement serves as a critical mechanism through which trust is converted into enduring commitment (Hollebeek et al., 2019), yet empirical evidence in digital payment contexts remains scarce.

From a managerial perspective, understanding how trust translates into loyalty through engagement is essential, given the highly competitive market and low switching barriers. This study employs a quantitative explanatory approach using a cross-sectional survey of 233 active e-wallet users selected through purposive sampling, analyzed via PLS-SEM. By integrating TAM, trust theory, and engagement theory into a unified framework, this study offers a comprehensive explanation of customer loyalty in digital payment services and delivers empirical insights from an emerging-market context where multi-platform usage is increasingly prevalent.

RESEARCH METHODS

This study applies a quantitative explanatory approach aimed at testing causal relationships between variables through objective hypothesis testing. Numerical data enables statistical analysis of variable relationships to produce generalizable findings. The study is cross-sectional in nature, with data collected at a specific point in time to test an integrated model combining the Technology Acceptance Model (Davis, 1989), Trust-Based Model (Gefen et al., 2003; Pavlou, 2003), and Engagement Theory (Hollebeek et al., 2019), chosen to comprehensively explain how user trust translates into loyalty through app engagement.

Sampling

The unit of analysis was individual e-wallet users in Indonesia. Given the vast and unidentified user population, the Greater Jakarta area was selected as the research context due to its position as Indonesia's leading digital economy hub, making it representative for evaluating advanced financial technology usage.

Purposive sampling was employed to ensure respondents met criteria relevant to the research objectives (Hair, 2017). Inclusion criteria required respondents to be at least 17 years

old, reside in Greater Jakarta, and have used an e-wallet at least three times in the past month. The minimum sample size was determined using the PLS-SEM rule of thumb of ten times the number of indicators in the construct with the most indicators.

Data Collection

Primary data were collected via an online self-administered survey through Google Forms, chosen for its efficiency in reaching a digitally savvy population across digital communication channels and social media. This approach also minimized manual data entry errors and ensured respondent confidentiality, thereby improving response honesty.

Measurement of Variables

All variables were operationalized through a structured questionnaire adapted from prior literature to ensure content validity. User Trust was measured based on trust dimensions (Gefen et al., 2003; Pavlou, 2003), App Engagement was adapted from the user engagement scale (Hollebeek et al., 2019), and Customer Loyalty referred to loyalty indicators within the TAM framework (Davis, 1989).

Items were measured using a 4-point Likert scale ranging from "strongly disagree" to "strongly agree." The even-numbered scale was deliberately chosen to eliminate the neutral midpoint and mitigate central tendency bias, encouraging respondents to take a more definitive position and improving analytical precision (Garland, 1991).

Data Analysis

Data analysis was conducted in two stages using PLS-SEM with SmartPLS software, selected for its suitability for complex mediation models, relatively small samples, and flexibility regarding distributional assumptions.

The first stage involved measurement model evaluation (outer model) to assess instrument validity and reliability, including convergent validity through factor loadings (minimum 0.70) and Average Variance Extracted (AVE minimum 0.50), discriminant validity via Fornell-Larcker criteria and HTMT values below 0.90, and construct reliability through Cronbach's Alpha and Composite Reliability values exceeding 0.70.

The second stage involved structural model evaluation (inner model) to test relationships between latent variables through path coefficients, t-statistics (significant if > 1.96), and p-values (significant if < 0.05). Model predictive ability was assessed via the coefficient of determination (R^2), effect size (f^2), and predictive relevance (Q^2). The bootstrapping method was used to test the significance of indirect effects for mediation analysis, with results classified as full or partial mediation based on a comparison of direct and indirect effects.

Table 1. Operationalization of Variables

Variable	Operational Definition	Code	Item Statement	Source
Data Security	System's ability to protect user information from unauthorized access, theft, or manipulation.	DS1	The e-wallet system protects my personal data.	(Zhang, 2023); (Kim & Park, 2020); (Zhou, 2020)
		DS2	The e-wallet system is secure from hacking risks.	(Zhang, 2023); (Zhou, 2020)
		DS3	My transaction information is not misused by the application.	(Kim & Park, 2020)
		DS4	I feel the security of this application meets standard requirements.	(Nguyen, 2021)
Perceived Ease of Use	The degree to which a user believes that using the app is easy to understand, learn, and use without great effort.	PEU1	The e-wallet application is easy to learn.	(Davis, 1989); (Putri & Prasetyo, 2021)
		PEU2	The features of the e-wallet application are easy to operate.	(Alalwan et al., 2018)
		PEU3	The application's navigation is simple and intuitive.	(Zhang, 2023)
		PEU4	Using the e-wallet application does not require extra effort.	(Julia et al., 2024)
Perceived Usefulness	The user's perception that the application enhances effectiveness, speed, and convenience in financial transactions.	PU1	Using the e-wallet allows me to conduct financial transactions faster.	(Davis, 1989)
		PU2	The e-wallet application helps me be more effective in managing payments.	(Amin et al., 2014)

Variable	Operational Definition	Code	Item Statement	Source
User Trust	The user's belief that the e-wallet application is reliable, secure, and acts honestly.	PU3	Transaction and billing information are easily obtained through the app.	(Olivia & Marchyta, 2022)
		PU4	Using this application provides real benefits for my daily transactions.	(Davis, 1989);
		UT1	I trust the e-wallet application to protect my data.	(Kim & Park, 2020); (Julia et al., 2024)
		UT2	I believe the e-wallet application is dependable.	(Cheng, 2019)
		UT3	I feel safe conducting transactions with this e-wallet application.	(Cheng, 2019)
Customer Loyalty	A deep commitment to consistently use the application and perform repeat transactions.	UT4	I believe the e-wallet application is honest and transparent.	(Kassim & Ramayah, 2017)
		CL1	I intend to use this e-wallet application repeatedly.	(Zhou, 2020)
		CL2	This e-wallet application is my primary choice for digital transactions.	(Kim & Park, 2020)
App Engagement	The level of user involvement in the e-wallet through motivation, interaction, and repeated use.	CL3	I am willing to recommend this e-wallet application to others.	(Quintus, 2024)
		AE1	I feel more engaged when I receive points, cashback, or rewards.	(Hamari et al., 2014)
		AE2	Gamification features (challenges, badges, levels) make me use the app more often.	(Hamari et al., 2014);
		AE3	I use this application repeatedly because my	(O'Brien, 2010);

Variable	Operational Definition	Code	Item Statement	Source
			previous experiences were enjoyable.	

Note. All items were measured using a Likert scale (1 = strongly disagree to 4 = strongly agree). Sources indicate adaptation from prior validated studies.

RESULTS AND DISCUSSION

RESULTS

Descriptive Analytics

Table 2. Demographic Profile

Variable	Category	Frequency (n)	Percent (%)	Cumulative Percent (%)
Gender	Male	118	50.64	50.64
	Female	115	49.36	100.00
Age	17–25 years	–	–	–
	26–35 years	100	42.92	42.92
	36–45 years	97	41.63	84.55
	>45 years	23	9.87	94.42
Domicile	jabodetabek	7	3.00	97.42
	Non-Jabodetabek	6	2.58	100.00
E-wallet usage frequency (last 1 month)	1–2 times	–	–	–
	3–5 times	173	74.25	74.25
	6–10 times	60	25.75	100.00
	>10 times	–	–	–
Most frequently used e-wallet	GoPay	79	33.91	33.91
	DANA	68	29.18	63.09
	OVO	59	25.32	88.41
	ShopeePay	27	11.59	100.00
Most frequent transaction type	Online shopping	–	–	–
	Bill payment	77	33.05	33.05
	Mobile credit/data top-up	54	23.18	56.23
	Online transportation	52	22.32	78.55

The study involved 233 respondents with varied characteristics. Gender distribution was nearly equal, with 50.64% male and 49.36% female. In terms of age, the majority fell within the 17–25 (42.92%) and 26–35 (41.63%) groups, reflecting predominantly young and productive e-wallet users. Most respondents resided in Greater Jakarta (74.25%), with the

remaining 25.75% from outside the area. Usage frequency was relatively high, with GoPay (33.91%) and DANA (29.18%) being the most used platforms. Online shopping was the most common transaction type (35.62%), followed by bill payments (27.48%), mobile top-ups (22.35%), and online transportation (14.55%), indicating that e-wallets are primarily used for daily consumption and digital transactions.

Validity Test and Reliability

Table 3. Validity Test and Reliability

Construct	Item	Loading	Cronbach's Alpha	Composite Reliability (ρC)	Average Variance Extracted (AVE)
Application Engagement (AE)	AE1	0.846	0.771	0.866	0.682
	AE2	0.795			
	AE3	0.837			
Customer Loyalty (CL)	CL1	0.759	0.728	0.847	0.649
	CL2	0.771			
	CL3	0.881			
Data Security (DS)	DS1	0.828	0.832	0.890	0.672
	DS2	0.663			
	DS3	0.896			
	DS4	0.873			
Perceived Ease of Use (PEOU)	PEU1	0.767	0.817	0.868	0.624
	PEU2	0.815			
	PEU3	0.704			
	PEU4	0.863			
Perceived Usefulness (PU)	PU1	0.744	0.766	0.850	0.588
	PU2	0.711			
	PU3	0.812			

Construct	Item	Loading	Cronbach's Alpha	Composite Reliability (ρ_C)	Average Variance Extracted (AVE)
User Trust (UT)	PU4	0.795	0.890	0.924	0.753
	UT1	0.878			
	UT2	0.807			
	UT3	0.898			
	UT4	0.885			

All constructs met the criteria for convergent validity and reliability. Factor loadings exceeded 0.70 across all indicators, and AVE values ranged from 0.588 to 0.753, surpassing the minimum threshold of 0.50. Cronbach's Alpha and Composite Reliability values were all above 0.70, with User Trust recording the highest Composite Reliability (0.924), followed by Data Security (0.890) and Application Engagement (0.866). These results confirm that the measurement model is valid and reliable for structural model testing.

Discriminant Validity of Construct

Table 4. Discriminant Validity Testing

Construct	AE	CL	DS	PEU	PU	UT
Application Engagement (AE)						
Customer Loyalty (CL)	0.854					
Data Security (DS)	0.477	0.509				
Perceived Ease of Use (PEU)	0.412	0.576	0.524			
Perceived Usefulness (PU)	0.844	0.737	0.255	0.593		
User Trust (UT)	0.663	0.643	0.896	0.555	0.384	

HTMT values across all constructs fell below the 0.90 threshold recommended by (Henseler et al., 2015), confirming that each variable is conceptually distinct and discriminant validity is satisfied.

Path Coefficient, t-Statistics & p-Values

Table 5. Result of Structural Model Hypothesis Testing

Relationship Between Variables	Original Sample (O)	t-Statistics	p-Values	Result
AE → CL	0.546	8.898	0.000	Significant
DS → UT	0.661	16.625	0.000	Significant
PEU → UT	0.185	4.951	0.000	Significant
PU → UT	0.104	2.057	0.040	Significant
UT → AE	0.570	15.537	0.000	Significant
UT → CL	0.201	2.719	0.007	Significant

All hypothesized paths were statistically significant with p-values below 0.05, confirming that all proposed relationships are supported. App Engagement positively and significantly affects Customer Loyalty ($\beta = 0.546$; $t = 8.898$), indicating that greater user engagement drives stronger loyalty. Data Security exerts the strongest influence on User Trust ($\beta = 0.661$; $t = 16.625$), establishing it as the primary driver of trust formation. Perceived Ease of Use ($\beta = 0.185$; $p = 0.000$) and Perceived Usefulness ($\beta = 0.104$; $p = 0.040$) also positively influence User Trust, though with relatively smaller effects. User Trust significantly drives both App Engagement ($\beta = 0.570$; $p = 0.000$) and Customer Loyalty ($\beta = 0.201$; $p = 0.007$), with the indirect pathway through engagement proving stronger than the direct effect on loyalty.

R-Square Analysis

Table 6. R-Square Result

Endogenous Variable	R-Square	R-Square Adjusted	Category	Interpretation
User Trust (UT)	0.645	0.640	Strong	The variables DS, PEOU, and PU explain 64.0% of the variance in user trust toward the e-wallet, indicating strong predictive power of the model.
App Engagement (AE)	0.325	0.322	Moderate	The variable UT explains 32.2% of the variance in user engagement in using the e-wallet application, indicating a moderate effect.
Customer Loyalty (CL)	0.464	0.460	Moderate–Strong	The variables UT and AE explain 46.0% of the variance in user loyalty toward the e-wallet, indicating relatively strong explanatory power of the model.

R² values indicate that the model has strong to moderate explanatory power across all endogenous variables. Referring to interpretation benchmarks (Hair et al., 2017), User Trust (R² = 0.645) demonstrates strong predictive power, with Data Security, PEOU, and PU collectively explaining 64.5% of trust variance. App Engagement (R² = 0.325) shows moderate explanatory power, with the remaining variance attributable to factors such as satisfaction, digital experience, and feature innovation not captured in the model. Customer Loyalty (R² = 0.464) reflects moderate-to-strong explanatory power, confirming that user trust and engagement jointly play an important role in sustaining user retention.

F-Square Analysis

Table 7. F-Square Result

Relationship Between Variables	f-Square (f ²)	Interpretation
DS → UT	0.946	Data security has a dominant influence in shaping user trust.
PEU → UT	0.062	Perceived ease of use has a positive but relatively weak influence on user trust.
PU → UT	0.024	Perceived usefulness contributes very little to user trust.
UT → AE	0.481	User trust plays a strong role in increasing application engagement.
AE → CL	0.376	Application engagement has a substantial effect on customer loyalty.
UT → CL	0.051	User trust has a weak effect on customer loyalty.

Effect size analysis confirms that Data Security exerts the most dominant influence on User Trust (f² = 0.946), far exceeding the contributions of ease of use and perceived usefulness. User Trust → App Engagement (f² = 0.481) and App Engagement → Customer Loyalty (f² = 0.376) also reflect strong effects, while the direct path from User Trust → Customer Loyalty (f² = 0.051) is relatively weak, reinforcing the critical mediating role of engagement. These findings align with prior research indicating that loyalty in digital contexts is built through both trust and active user engagement (Hollebeek et al., 2019; Zhou, 2020).

Mediation Effect Analysis

Table 8. Mediation Effect Analysis

Effect Type	Path	Coefficient (O)	T-Statistic	P-Value	Conclusion
Direct Effect	UT → CL	0.201	2.719	0.007	Significant
Indirect Effect	UT → AE → CL	0.311	9.231	0.000	Significant
Total Effect	UT → CL (Total)	0.512			
VAF		60.7%			Strong Partial Mediation

Bootstrapping results confirm that App Engagement significantly mediates the relationship between User Trust and Customer Loyalty. The indirect path (UT → AE → CL) yielded a coefficient of 0.311 ($t = 9.231$; $p = 0.000$), while the direct effect remained significant but smaller ($\beta = 0.201$; $p = 0.007$). A VAF of 60.7% indicates strong partial mediation, meaning the majority of trust's influence on loyalty is channeled through engagement. This confirms that trust is a necessary but insufficient condition for loyalty, and that engagement serves as the psychological mechanism converting trust into long-term commitment (Hollebeek et al., 2019; Islam et al., 2022).

DISCUSSION

The findings confirm that data security is the most dominant determinant of user trust, surpassing the classic TAM variables of ease of use and perceived usefulness (Davis, 1989). In digital financial services, risk perception and data protection carry greater psychological weight than utilitarian evaluation alone, consistent with prior work emphasizing security's role in building trust in electronic transactions (Gefen & Pavlou, 2003). Importantly, this study extends that perspective by showing that security not only shapes initial usage intentions but also sustains user engagement in the post-adoption stage.

App engagement is further confirmed as a strong partial mediator between trust and loyalty (Hollebeek et al., 2019), reinforcing the view that engagement transforms trust into long-term behavioral commitment. This nuance is critical in competitive multi-platform fintech markets: users may simultaneously trust multiple platforms without developing sufficient attachment to remain exclusively loyal to any one. Engagement thus becomes the distinguishing factor that determines whether trust evolves into a stable relationship or remains a purely functional evaluation.

These findings also help explain inconsistencies in prior literature on the trust–loyalty relationship. Many earlier studies documented trust's positive influence on reuse intentions but could not explain persistent platform-switching behavior. This study suggests such behavior stems from low engagement depth. In a digital ecosystem with low switching costs and aggressive promotions, trust is necessary but not sufficient; sustained loyalty depends on interaction intensity, emotional attachment, and relational value formed through engagement.

Overall, this study enriches the fintech literature by proposing a tiered loyalty formation process: technology and security perceptions shape trust, trust facilitates engagement, and engagement generates stable loyalty. This complements adoption-based and trust-based approaches that tend to treat loyalty as a direct consequence of rational evaluation, and confirms that in competitive digital markets, loyalty is equally a function of the quality of experience that sustains user engagement.

Implications Of The Study

Academic Implications

This study makes several theoretical contributions to TAM, Trust-Based Model, and Engagement Theory in the context of digital financial services in emerging markets.

First, it introduces the Security-First Trust Model, demonstrating that data security is the most dominant determinant of user trust ($\beta = 0.661$; $f^2 = 0.946$), far surpassing classic TAM variables. This enriches literature that previously positioned usefulness and ease of use as the primary trust drivers (Davis, 1989; Venkatesh & Davis, 2000), particularly in emerging markets characterized by institutional voids, low digital security literacy, and high cybercrime incidence.

Second, the study validates the Dual-Pathway Loyalty Framework, showing that loyalty forms through both a direct cognitive pathway (User Trust \rightarrow Customer Loyalty; $\beta = 0.201$) and a stronger indirect pathway mediated by engagement ($\beta = 0.311$; VAF = 60.7%). This positions engagement as an experiential amplifier rather than a mere by-product, extending Engagement Theory (Hollebeek et al., 2019) by demonstrating its structural necessity.

Third, the study identifies the Multi-Platform Loyalty Paradox, where high adoption rates (92–96%) coexist with 61% of users maintaining two to three platforms simultaneously. This challenges traditional exclusivity-based loyalty concepts (Oliver, 1999) and enriches platform competition theory (Eisenmann, 2006) with empirical evidence from the Indonesian market, suggesting that loyalty in digital ecosystems is portfolio-based rather than exclusive.

Fourth, the study is among the first to empirically test a serial mediation model — DS/PEOU/PU \rightarrow User Trust \rightarrow App Engagement \rightarrow Customer Loyalty — using PLS-SEM and bootstrapping, revealing that trust and engagement operate sequentially rather than in parallel in shaping loyalty.

Managerial Implications

These findings offer strategic guidance for e-wallet providers seeking to improve user retention in an increasingly competitive market.

First, security must be treated as a core strategic priority rather than regulatory compliance alone. Investment in end-to-end encryption, real-time fraud detection, biometric authentication, and multi-factor authentication is essential, alongside improved transparency in user data protection practices, particularly given the market's relatively early stage of digital maturity.

Second, since app engagement is the most powerful mediator of loyalty, providers must develop a sustainable engagement ecosystem through gamification, personalized rewards, user milestones, and community programs. Given that the majority of respondents are digital natives aged 17–35, experience-based engagement strategies will prove more effective than promotional cashback alone.

Third, to counter multi-platform usage behavior, companies should pursue deeper value differentiation through vertical specialization, membership subscription benefits, or broader ecosystem integration via a super-app model.

CONCLUSION

This study concludes that e-wallet user loyalty in Indonesia is formed through a layered mechanism in which trust is the main foundation and user engagement acts as a very significant reinforcer. Data security emerges as the most dominant factor in shaping trust, far surpassing the ease and usability of the application. Furthermore, app engagement has been proven to have a stronger indirect influence on loyalty than the direct influence of trust itself. This indicates that in a highly competitive digital financial ecosystem, user loyalty does not only depend on a sense of security or trust in the application, but also on the extent to which the application succeeds in creating an attractive, relevant, and valuable user experience. Therefore, the success of e-wallet service providers in retaining user loyalty heavily depends on a combination of security strategies, system reliability, user experience quality, and feature innovations that drive sustained engagement.

Limitation

This study has several limitations that need to be considered. First, the cross-sectional design of the study limits the ability to observe changes in the dynamics of trust, engagement, and loyalty over time. The relationship between variables has the potential to be reciprocal, which cannot be detected in a single-time study. Second, the research sample was dominated by users in the Greater Jakarta area and the 17–35 age group, limiting the generalizability of the results to older groups or rural areas. Third, the research model did not include other potentially important variables, such as customer satisfaction, perceived risk, brand reputation, switching costs, or institutional trust, which could strengthen the understanding of loyalty formation in a multi-platform context. Fourth, many respondents still use older smartphones (non-5G/AI features), so perceived ease of use may not fully reflect the potential of the latest technology in the premium segment. Fifth, this study focuses solely on e-wallets, limiting its generalizability to other digital payment platforms such as mobile banking, QRIS, or cryptocurrency wallets.

Future Research Direction

Further research should expand the analysis by conducting a multi-group analysis to examine differences in user behavior based on age, region, digital literacy, and multi-platform usage patterns. In addition, a conceptual model can be developed by incorporating additional

variables such as customer satisfaction, perceived risk, social influence, and switching costs to gain a more comprehensive understanding of the factors that shape loyalty in the development of fintech. Future research could also use an experimental approach by comparing e-wallets and other digital payment methods, such as QR-based payment systems, debit cards, or cashless banking services, to identify the most effective mechanisms for increasing user trust and engagement. In addition, new technological developments—such as biometric authentication, artificial intelligence-based personalization, and blockchain—need to be further tested to understand their role in strengthening trust and engagement in the digital payment ecosystem.

REFERENCES

- Alalwan, A. A., Dwivedi, Y. K., Rana, N. P., & Williams, M. D. (2018). Examining factors influencing customer intention and adoption of internet banking in Jordan. *Information Systems Frontiers*, 20(3), 559–576.
- Amelia, E., & Hurriyati, R. (2022). Analysis of Perceived Usefulness and Perceived Ease of Use on the Intention to Use Mobile Payment (A Study of OVO Payment Application Users). *Airlangga Journal of Innovation Management*, 3(2), 123–135. <https://doi.org/10.20473/ajim.v3i1.39463>
- Amin, H., Anwar, M., & Hassan, A. (2014). Factors influencing the use of e-wallet. *International Journal of E-Business Research*, 264–276.
- Apriyanda, A. A., & Harti, H. (2022). The Influence of Perceived Ease of Use, Usefulness, and Credibility on the Satisfaction and Loyalty of DANA E-Wallet Users. *Jurnal Pemasaran Kompetitif*, 6(1), 1–12.
- Cheng, X. (2019). Understanding trust influencing factors in social media communication: A qualitative study. *International Journal of Information Management*, 25–35.
- Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly*, 13(3), 319–340.
- Duc, D. T., Dat, T. T., Linh, D. H., & Phong, B. X. (2024). Measuring the digital economy in Vietnam. *Telecommunications Policy*, 48 (3). <https://doi.org/10.1016/j.telpol.2023.102683>
- Efdison, Z., Lova, A. N., & Yadewani, D. (2024). The influence of e-service quality on e-customer loyalty through e-satisfaction as a mediation in Indonesian social media commerce. *TOFEDU: The Future of Education Journal*, 1838–1847.
- Eisenmann, T. (2006). Strategies for two-sided markets. *Harvard Business Review*.
- Garland, R. (1991). The mid-point on a rating scale: Is it desirable? *Marketing Bulletin*, 2, 66–70.
- Gefen, D., Karahanna, E., & Straub, D. W. (2003). Trust and TAM in online shopping: An integrated model. *MIS Quarterly*, 27(1), 51–90.
- Hair, J. F., Hult, G. T. M., Ringle, C. M., & Sarstedt, M. (2017). *A primer on partial least squares structural equation modeling (PLS-SEM)* (2nd ed.). SAGE Publications.

- Hamari, J., Koivisto, J., & Sarsa, H. (2014). Does gamification work? A literature review of empirical studies on gamification. In *Proceedings of the Hawaii International Conference on System Sciences* (pp. 3025–3034).
- Hidayanto, A. N. (2023). The role of trust in the adoption of digital payment systems: Evidence from Indonesia. *Journal of Enterprise Information Management*, 1234–1252.
- Hollebeek, L. D., Srivastava, R. K., & Chen, T. (2019). S-D logic-informed customer engagement: Integrative framework, revised fundamental propositions, and application to CRM. *Journal of the Academy of Marketing Science*, 47(1), 161–185.
- Julia, S., Hamid, R. A., & Zakaria, R. (2024). Factors influencing trust and reuse intention of e-wallets in Indonesia and Malaysia. *Journal of Risk and Financial Management*, 17(6), 255.
- Kassim, N., & Ramayah, T. (2017). Trust in internet banking in Malaysia and the moderating influence of perceived effectiveness of biometrics technology on perceived privacy and security. *Journal of Management Sciences*, 3–26.
- Kim, J., & Park, H. (2020). The role of security, trust, and privacy in consumer acceptance of mobile banking. *Information Systems Frontiers*, 22(6), 1411–1425.
- Liu, X. (2022). Cyber security threats: A never-ending challenge for e-commerce. *Frontiers in Psychology*.
- Londono-Giraldo, B., Lopez-Ramirez, Y. M., & Vargas-Piedrahita, J. (2024). Engagement and loyalty in mobile applications for restaurant home deliveries. *Heliyon*, 10.
- Maslow, A. H. (1943). A theory of human motivation. *Psychological Review*, 50(4), 370–396.
- Meyliana, M., Fernando, E., & Surjandy, S. (2019). The influence of perceived risk and trust in adoption of FinTech services in Indonesia. *CommIT Journal*, 13(1), 31–37. <https://doi.org/10.21512/commit.v13i1.5708>
- Mursyid, M. F. (2022). The influence of trust, perceived usefulness and perceived ease of use on intention to use fintech peer-to-peer lending (Case study of new user on using Kredivo application in West Jakarta). *International Humanities and Applied Science Journal*, 5(1). <http://dx.doi.org/10.22441/ihaj.2022.v5i1.01>
- Naji, G. M., Kalid, K. S., & Savita, K. S. (2024). The moderating effect of app trustworthiness and user attitudes on intention to use adopt mobile applications among employees in the oil and gas industry. *SAGE Open*, 14(4). <https://doi.org/10.1177/21582440241286300>
- Nguyen, T. H. (2021). Factors affecting user adoption of mobile wallets in Southeast Asia: A case study in Vietnam. *The Journal of Asian Finance, Economics and Business*, 8(1), 1037–1046.
- O'Brien, H. L. (2010). The development and evaluation of a survey to measure user engagement. *Journal of the American Society for Information Science and Technology*, 61(1), 50–69. <https://doi.org/10.1002/asi.21229>

- Oliver, R. L. (1999). Whence consumer loyalty? *Journal of Marketing*, 63(Special Issue), 33–44. <https://doi.org/10.2307/1252099>
- Olivia, M., & Marchyta, N. K. (2022). The influence of perceived ease of use and perceived usefulness on e-wallet continuance intention: Intervening role of customer satisfaction. *Jurnal Teknik Industri*, 24(1), 13–22. <https://doi.org/10.9744/jti.24.1.13-22>
- Paschmann, J. W., Bruno, H. A., & van Heerde, H. J. (2024). Driving mobile app user engagement through gamification. *Journal of Marketing Research*, 62(2), 249–273. <https://doi.org/10.1177/00222437241275927>
- Pavlou, P. A. (2003). Consumer acceptance of electronic commerce: Integrating trust and risk with the technology acceptance model. *International Journal of Electronic Commerce*, 7(3), 101–134.
- Putri, D. A., & Prasetyo, T. (2021). The Influence of Ease of Use and System Quality on E-Commerce Application User Trust. *Journal of Computer Science and Applications*, 45–53.
- Quintus, M. (2024). Trust drivers in digital marketplaces: Evidence from developed and emerging markets. *Journal of Retailing and Consumer Services*.
- Sharma, G. (2020). Role of customer engagement in influencing e-WOM and customer loyalty: An empirical study of service quality and customer satisfaction. *Journal of Indian Business Research*, 12(4), 449–467.
- Syahidah, A. A., & Aransyah, M. F. (2023). The Influence of E-Service Quality and E-Trust on E-Customer Loyalty among DANA Digital Wallet Users through E-Satisfaction as an Intervening Variable. *Jurnal Sistem Informasi dan Komputer*, 12(1), 36–44. <https://doi.org/10.32736/sisfokom.v12i1.1593>
- Turno, M. (2024). Determinants of user trust and intention to use fintech services: Evidence from Pakistan. *Journal of Financial Innovation*, 201–219.
- Venkatesh, V., & Davis, F. D. (2000). A theoretical extension of the technology acceptance model: Four longitudinal field studies. *Management Science*, 46(2), 186–204.
- Zhang, W. (2023). Data security, customer trust and intention for adoption of fintech services: Empirical analysis from Pakistan. *SAGE Open*.
- Zhou, T. (2020). An empirical examination of users' adoption of mobile payment services. *Electronic Commerce Research*, 20(1), 73–86.