Indonesian Journal of Sustainability Accounting and Management
ISSN 2597–6214 | e–ISSN 2597–6222
DOI: 10.20448/ijsam.v10i2.9406

Customer Adoption of AI-Enabled Digital Financial Services: Integrating Blockchain-Based Payment Trust and AI Service Intelligence

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Abstract: The convergence of artificial intelligence (AI) and blockchain technologies is transforming digital financial services, yet limited empirical evidence explains how these technologies jointly shape customer adoption. This study examines customer adoption of AI-enabled digital financial services by integrating blockchain-based payment trust and AI service intelligence within a unified technology adoption framework. Using survey data collected from 220 users and analyzed through partial least squares structural equation modeling (PLS-SEM), the findings reveal that AI service intelligence is the primary determinant of customer attitude, which subsequently drives adoption intention. In contrast, blockchain-based payment trust does not exert a significant direct or indirect influence on customer attitude or adoption intention. These findings are consistent with the view that trusted payment infrastructure may function as a foundational condition rather than a primary differentiating driver of customer adoption in mature digital financial environments. Customer attitude also serves as a significant mediating mechanism, whereas technology awareness does not moderate the proposed relationships. This study extends technology adoption research by demonstrating the dominant role of AI-enabled service intelligence relative to infrastructure-level trust in integrated AI–blockchain financial ecosystems. The findings provide practical guidance for banks, fintech firms, and policymakers seeking to develop intelligent, customer-centric, and trustworthy digital financial services.

Keywords: Adoption intention, AI service intelligence, AI-enabled financial services, blockchain-based payment trust, customer attitude, technology awareness, PLS-SEM.

Article info: Received 9 June 2026 | revised 13 July 2026 | accepted 5 August 2026 | published 23 September 2026

Recommended citation: Nguyen, M. T., Thanh, T. T. T., & Hoa, N. T. (2026). Customer Adoption of AI-Enabled Digital Financial Services: Integrating Blockchain-Based Payment Trust and AI Service Intelligence. *Indonesian Journal of Sustainability Accounting and Management*, *10*(2), 154–171. https://doi.org/10.20448/ijsam.v10i2.9406

INTRODUCTION

The digital transformation of financial services has accelerated the emergence of a new generation of intelligent financial ecosystems in which artificial intelligence (AI), blockchain technology, and advanced data analytics collectively reshape the creation and delivery of financial value. Rather than serving merely as enabling technologies, AI and blockchain have become fundamental infrastructures supporting intelligent

decision-making, personalized service provision, secure digital transactions, and continuous customer engagement. This technological convergence is redefining how financial institutions compete in increasingly digital markets while enhancing operational resilience, transaction transparency, and service efficiency. As digital finance continues to evolve beyond the simple digitization of traditional banking activities, its long-term success increasingly depends on developing trusted and intelligent financial environments that encourage customers to adopt and continuously use innovative financial services. Consequently, understanding the mechanisms through which emerging digital technologies influence customer adoption has become an important research priority for both scholars and practitioners seeking to promote sustainable digital financial transformation (Huang & Rust, 2021; Kshetri, 2018; Nguyen, Truong, Tan, Dang, & Ngoc, 2025; Puntoni, Reczek, Giesler, & Botti, 2021; Treiblmaier, 2018).

The growing adoption of AI-enabled digital financial services reflects a fundamental shift in the way financial institutions interact with customers, moving from standardized service delivery toward intelligent, adaptive, and highly personalized financial experiences. Advances in AI enable financial service providers to analyze customer preferences, anticipate financial needs, automate complex decision-making processes, and deliver real-time recommendations that enhance service quality and customer satisfaction (Huang & Rust, 2021; Puntoni et al., 2021). At the same time, the expansion of digital financial ecosystems has intensified concerns regarding transaction security, privacy protection, data integrity, and institutional trust, making blockchain technology an increasingly important component of modern financial infrastructures (Kshetri, 2018; Treiblmaier, 2018). By providing decentralized verification mechanisms, transparent transaction records, and tamper-resistant payment systems, blockchain strengthens customers' confidence in digital financial transactions while reducing perceived risks associated with technology-mediated financial services. Together, AI-driven service intelligence and blockchain-enabled payment trust represent complementary technological capabilities that simultaneously enhance service value and reinforce transactional reliability. Their integration therefore provides a promising foundation for fostering long-term customer engagement and supporting the sustainable development of intelligent digital financial services.

Despite the rapid expansion of research on AI, blockchain, and digital financial innovation, existing knowledge remains fragmented in explaining customer adoption of AI-enabled digital financial services. Most previous studies have examined either AI-related capabilities, such as personalization, automation, and intelligent decision support, or blockchain-related attributes, including transaction security, transparency, and decentralized trust, as independent drivers of technology adoption. Although these studies have generated important insights, they provide only a partial understanding of customer decision-making because intelligent service capabilities and trusted payment infrastructures coexist within contemporary digital financial ecosystems and jointly shape customers' service experiences. Furthermore, prior research has predominantly emphasized technological characteristics or behavioral intention models while paying comparatively less attention to the complementary mechanisms through which AI service intelligence and blockchain-based payment trust interact to influence customer attitudes and subsequent adoption intentions. This theoretical fragmentation limits our understanding of how multiple technological capabilities collectively facilitate customer acceptance of intelligent financial services and, consequently, how digital financial innovation can contribute to sustainable financial transformation.

To address these limitations, this study develops an integrated research framework that explains customer adoption of AI-enabled digital financial services by jointly examining the roles of blockchain-based payment trust and AI service intelligence. Rather than viewing trust and intelligent service capability as isolated technological attributes, the proposed model conceptualizes them as complementary enablers that shape customers' evaluations of AI-enabled financial services through their influence on customer attitudes and subsequent adoption intentions. Drawing upon established technology adoption theories and contemporary research on intelligent financial services, this study further recognizes that customers' awareness of emerging digital technologies may strengthen or weaken the translation of favorable attitudes into actual adoption intentions. Incorporating technology awareness as a moderating mechanism, therefore, provides a more nuanced explanation of individual decision-making in increasingly intelligent financial environments. By integrating these technological, cognitive, and behavioral perspectives within a unified framework, the

proposed model extends existing technology adoption research and offers a more comprehensive understanding of customer adoption in the evolving landscape of digital finance.

Against this background, the present study investigates the mechanisms underlying customer adoption of AI-enabled digital financial services by integrating blockchain-based payment trust, AI service intelligence, customer attitude, adoption intention, and technology awareness within a unified analytical framework. Specifically, the study examines how trusted payment infrastructures and intelligent service capabilities jointly shape customers' attitudes toward AI-enabled financial services, how these attitudes translate into adoption intentions, and whether technology awareness strengthens this behavioral relationship. By addressing these issues, the study makes several contributions to the literature. First, it extends existing technology adoption research by integrating complementary technological capabilities within a single explanatory framework, thereby offering a more holistic perspective on customer adoption in AI-enabled financial services. Second, it advances the emerging literature on intelligent digital finance by clarifying the distinct yet interconnected roles of blockchain-enabled trust and AI-driven service intelligence in shaping customer decision-making. Finally, the findings provide practical insights for financial institutions, FinTech firms, and policymakers seeking to develop trustworthy, intelligent, and sustainable digital financial ecosystems that encourage broader customer participation and long-term digital transformation.

LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

Blockchain-Based Payment Trust and Customer Attitude

Trust has long been recognized as a fundamental determinant of customer acceptance and continued use of digital financial services, particularly in technology-mediated environments where uncertainty, perceived risk, and information asymmetry are inherent characteristics of financial transactions (Gefen, Karahanna, & Straub, 2003; Pavlou, 2003). Unlike traditional face-to-face financial interactions, digital financial services require customers to rely on technological infrastructures when exchanging sensitive financial information and conducting monetary transactions. Under these circumstances, trust serves as a critical cognitive mechanism that reduces uncertainty, strengthens confidence, and facilitates favorable evaluations of technology-enabled financial services. In recent years, blockchain technology has emerged as a trust-enabling infrastructure for digital payments by providing decentralization, immutability, transparency, and cryptographic security (Kshetri, 2018; Treiblmaier, 2018). Rather than merely improving transaction efficiency, these technological characteristics collectively establish a secure and transparent payment environment that minimizes information asymmetry and opportunistic behavior while enhancing customers' confidence in digital financial transactions. Consequently, blockchain-based payment trust extends beyond confidence in a specific payment technology and represents customers' broader belief that the underlying digital payment infrastructure is reliable, secure, and capable of supporting trustworthy financial interactions.

Prior studies have consistently demonstrated that trust in blockchain-based payment systems positively influences customers' evaluations of digital financial services, leading to more favorable attitudes and stronger behavioral intentions (Shahzad, Xiu, Wang, & Shahbaz, 2023; Wang, Han, & Beynon-Davies, 2022). When customers perceive payment infrastructures as secure, transparent, and resistant to manipulation, they are more likely to develop confidence not only in payment processes but also in the overall digital service environment. This mechanism becomes particularly important in AI-enabled digital financial services, where intelligent financial recommendations, automated decision-making, and personalized service delivery rely heavily on continuous digital transactions and extensive data exchange. Customers are unlikely to fully appreciate the benefits of AI-driven financial services if they question the security or integrity of the payment infrastructure through which these services are delivered. Despite the growing body of research on blockchain technology, existing studies have predominantly examined blockchain trust as an antecedent of blockchain adoption, cryptocurrency usage, or digital payment acceptance (Shahzad et al., 2023; Wang et al., 2022). Comparatively limited attention has been devoted to understanding blockchain-based payment trust as an infrastructure-level trust mechanism that supports broader AI-enabled digital financial services. This perspective is particularly relevant because customers often evaluate intelligent financial services within a

holistic digital ecosystem rather than assessing individual technologies in isolation. Building upon trust theory and technology acceptance research, the present study argues that blockchain-based payment trust functions as a foundational cognitive antecedent that enhances customers' overall evaluations of AI-enabled digital financial services, thereby fostering more favorable customer attitudes. Accordingly, the following hypothesis is proposed.

H_1: Blockchain-based payment trust positively influences customer attitude toward AI-enabled digital financial services.

AI Service Intelligence and Customer Attitude

AI has evolved from a supporting automation tool into a strategic service capability that fundamentally reshapes the delivery of digital financial services. In contemporary financial environments, AI is no longer valued solely for its computational efficiency but increasingly for its ability to generate intelligent, adaptive, and customer-centric service experiences. By leveraging machine learning, predictive analytics, and natural language processing, AI enables financial institutions to continuously interpret customer preferences, anticipate financial needs, provide personalized recommendations, and facilitate real-time decision support (Huang & Rust, 2021). Consequently, AI service intelligence reflects customers' perceptions of an AI system's capability to deliver intelligent, responsive, and value-enhancing financial services rather than merely executing automated transactions. From a service perspective, AI service intelligence represents an important source of value co-creation between financial institutions and customers. Service-Dominant Logic suggests that value is created through interactive service experiences rather than through technology itself. Accordingly, customers evaluate AI-enabled financial services not only based on technological sophistication but also on the extent to which AI enhances service quality, responsiveness, personalization, and decision effectiveness (Huang & Rust, 2021). When AI systems demonstrate a strong ability to understand customer needs and provide relevant financial insights, customers are more likely to perceive financial services as useful, intelligent, and capable of supporting superior financial decision-making.

Previous empirical studies consistently indicate that intelligent and personalized AI services enhance customers' perceived value, satisfaction, and positive affective responses toward digital services (Puntoni et al., 2021; Rai, Constantinides, & Sarker, 2019). Within digital financial services, AI service intelligence can further reduce customers' cognitive effort, improve decision quality, and increase confidence in technology-assisted financial interactions. These intelligent capabilities strengthen customers' overall evaluations of financial service performance and contribute to the development of more favorable attitudes toward AI-enabled financial services. Nevertheless, existing studies also acknowledge that concerns regarding algorithmic opacity, perceived loss of human control, and uncertainty surrounding AI-generated decisions may limit customers' willingness to fully embrace AI-driven financial services (Puntoni et al., 2021). These findings suggest that customers' perceptions of AI intelligence, rather than AI adoption alone, constitute a critical determinant of favorable attitudinal responses. Although previous research has extensively examined AI adoption across various service settings, comparatively less attention has been devoted to understanding AI service intelligence as a distinct service capability within AI-enabled digital financial services. Most existing studies primarily emphasize technological acceptance or automation outcomes, while overlooking how customers evaluate the intelligence embedded in AI-enabled service interactions. Building upon Service-Dominant Logic and the emerging literature on AI-enabled services, the present study conceptualizes AI service intelligence as a strategic service capability that enhances customers' evaluations of AI-enabled financial services, thereby fostering more positive customer attitudes. Accordingly, the following hypothesis is proposed.

H_2: AI service intelligence positively influences customer attitude toward AI-enabled digital financial services.

Customer Attitude and Adoption Intention

Customer attitude has long been recognized as one of the most influential psychological determinants of technology adoption and usage behavior. Within the Technology Acceptance Model (TAM) and its subsequent extensions, attitude reflects an individual's overall evaluative judgment of a technology based on accumulated cognitive beliefs and affective responses, serving as a key mechanism through which technology-related

perceptions are translated into behavioral intentions (Davis, 1989; Venkatesh, Morris, Davis, & Davis, 2003; Venkatesh, Thong, & Xu, 2012). Rather than representing a simple emotional reaction, customer attitude captures a comprehensive evaluation of whether a technology is perceived as beneficial, desirable, and worthy of continued use. In digital financial services, customer attitude plays an especially important role because financial decisions often involve higher levels of uncertainty, perceived risk, and financial consequences than many other technology adoption contexts. Customers typically evaluate not only the functional performance of digital financial services but also the extent to which these technologies align with their expectations regarding convenience, reliability, security, and overall service quality. Positive evaluations accumulated through these cognitive and affective assessments strengthen customers' confidence in digital financial services and increase their willingness to engage with emerging financial technologies (Oliveira, Faria, Thomas, & Popovič, 2014; Ryu, 2018).

The importance of customer attitude becomes even more pronounced in AI-enabled digital financial services, where intelligent algorithms increasingly participate in financial advisory, credit assessment, investment recommendations, and automated decision-making. Although AI provides substantial benefits in terms of efficiency, personalization, and decision support, customers remain responsible for the financial consequences of technology-assisted decisions. Consequently, favorable attitudes toward AI-enabled financial services reduce psychological resistance, mitigate uncertainty associated with automated decision-making, and encourage customers to embrace AI-supported financial interactions. In this context, customer attitude functions as a critical psychological mechanism linking customers' evaluations of technological capabilities with their subsequent behavioral intentions. Previous studies have consistently reported that favorable customer attitudes significantly enhance individuals' intentions to adopt innovative financial technologies (Oliveira et al., 2014; Ryu, 2018). Building upon technology adoption theory, the present study argues that positive attitudes developed through trusted payment infrastructures and intelligent service experiences are expected to translate into stronger intentions to adopt AI-enabled digital financial services. Therefore, the following hypothesis is proposed.

H_3: Customer attitude positively influences adoption intention toward AI-enabled digital financial services.

The Mediating Role of Customer Attitude

Customer attitude has long been recognized as a central psychological mechanism through which customers translate their evaluations of technological characteristics into subsequent behavioral intentions. Technology adoption theories consistently argue that individuals rarely make adoption decisions based solely on objective technological attributes. Instead, customers first interpret and evaluate technological capabilities, develop an overall favorable or unfavorable attitude toward the technology, and subsequently form intentions regarding its adoption and continued use (Davis, 1989; Gefen et al., 2003; Venkatesh et al., 2012). Accordingly, customer attitude serves as an important cognitive and affective pathway linking technology-related perceptions with behavioral responses. Within AI-enabled digital financial services, this mediating process becomes particularly important because customers simultaneously evaluate multiple technological capabilities before deciding whether to adopt AI-supported financial services. Blockchain-based payment trust primarily reduces customers' concerns regarding payment security, transaction transparency, privacy protection, and the overall reliability of digital financial infrastructures. In contrast, AI service intelligence enhances customers' perceptions of personalization, service responsiveness, decision quality, and intelligent financial support. Although these technological capabilities address different dimensions of service evaluation, both contribute to shaping customers' overall attitudes toward AI-enabled financial services rather than directly determining behavioral intentions.

This perspective suggests that customers do not simply adopt AI-enabled financial services because blockchain technology is secure or because AI systems are intelligent. Instead, these technological capabilities first influence customers' cognitive evaluations and affective responses, which are subsequently integrated into an overall attitude toward the service. Once favorable attitudes are established, customers become more willing to engage with AI-enabled digital financial services despite the inherent uncertainty associated with technology-mediated financial decision-making. Consequently, customer attitude functions as a critical

psychological transmission mechanism through which both blockchain-based payment trust and AI service intelligence exert their influence on adoption intention. Previous research has consistently demonstrated that trust-related beliefs and perceived technological capabilities frequently affect behavioral intention indirectly through customers' attitudinal evaluations (Gefen et al., 2003; Venkatesh et al., 2012). Building upon this theoretical perspective, the present study proposes that customer attitude mediates the relationships between blockchain-based payment trust, AI service intelligence, and customers' adoption intention toward AI-enabled digital financial services. Accordingly, the following hypotheses are proposed.

H_{4a}: Customer attitude mediates the relationship between blockchain-based payment trust and adoption intention toward AI-enabled digital financial services.

H_{4b}: Customer attitude mediates the relationship between AI service intelligence and adoption intention toward AI-enabled digital financial services.

The Moderating Role of Technology Awareness

Technology awareness refers to an individual's knowledge, familiarity, and understanding of emerging digital technologies and their practical applications. Beyond simple technological literacy, technology awareness reflects customers' ability to recognize technological capabilities, interpret technology-related information, and evaluate the potential benefits and risks associated with innovative digital services (Aboelmaged & Hashem, 2019; Dwivedi et al., 2021). In technology adoption research, individuals with higher levels of technology awareness generally possess greater confidence in evaluating complex technological systems, thereby reducing uncertainty and facilitating more informed decision-making. Within AI-enabled digital financial services, technology awareness assumes particular importance because both artificial intelligence and blockchain technology involve sophisticated technological mechanisms that are often difficult for ordinary customers to fully understand. Unlike conventional digital banking services, AI-enabled financial services rely on intelligent algorithms, predictive analytics, and automated decision-making, while blockchain-based payment systems operate through decentralized verification mechanisms and cryptographic protocols. These technological characteristics create substantial information complexity, making customers' awareness and understanding of emerging technologies an important contextual factor influencing how technological attributes are interpreted.

From a theoretical perspective, technology awareness functions as a boundary condition that influences the extent to which customers translate technological evaluations into attitudinal responses. Customers with higher technology awareness are generally better able to recognize the security, transparency, and reliability offered by blockchain-based payment infrastructures while simultaneously appreciating the personalization, responsiveness, and decision-support capabilities provided by AI service intelligence. As a result, they are more likely to perceive these technological capabilities as valuable and trustworthy, thereby strengthening the formation of favorable attitudes toward AI-enabled digital financial services. Conversely, customers with lower technology awareness may experience greater uncertainty, perceive higher technological complexity, and have more difficulty recognizing the functional advantages of AI and blockchain technologies. Under such circumstances, the positive effects of blockchain-based payment trust and AI service intelligence on customer attitude may become less pronounced. Previous studies have suggested that individual differences in technology-related knowledge and familiarity significantly influence how customers evaluate and respond to emerging digital technologies (Aboelmaged & Hashem, 2019; Dwivedi et al., 2021). Building upon this perspective, the present study conceptualizes technology awareness as a moderating mechanism that strengthens the positive relationships between blockchain-based payment trust, AI service intelligence, and customer attitude. Accordingly, the following hypotheses are proposed.

H_{5a}: Technology awareness positively moderates the relationship between blockchain-based payment trust and customer attitude toward AI-enabled digital financial services.

H_{5b}: Technology awareness positively moderates the relationship between AI service intelligence and customer attitude toward AI-enabled digital financial services.

Summary of the proposed research model. The proposed model explains customer adoption of AI-enabled digital financial services by integrating blockchain-based payment trust and AI service intelligence as

antecedents of customer attitude, with technology awareness serving as a moderating variable. The conceptual framework is presented in Figure 1.

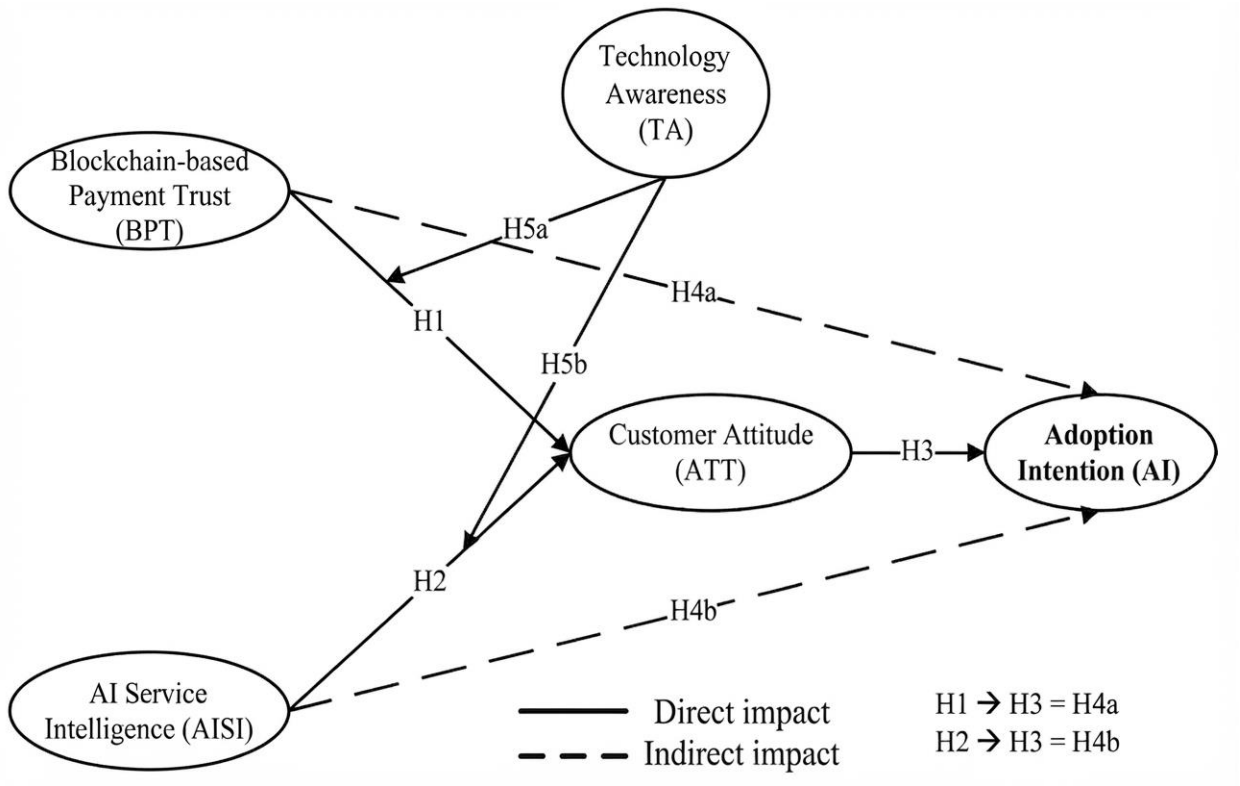

Figure 1: Research framework

METHODOLOGY

Research Design and Data Collection

This study employed a quantitative research design to investigate the factors influencing customer adoption of AI-enabled digital financial services. Given that the proposed research model examines multiple latent constructs and their structural relationships, a cross-sectional survey was considered an appropriate research strategy for capturing customers' perceptions, evaluations, and behavioral intentions toward emerging financial technologies. This design has been widely adopted in technology adoption and digital finance research because it enables the empirical examination of complex relationships among psychological and technological constructs within a real-world context.

Data were collected using a structured questionnaire administered to individuals who had prior experience using AI-enabled digital financial services, including digital banking applications incorporating AI-based functionalities such as chatbots, robo-advisory services, intelligent financial recommendations, and automated customer support. To ensure the appropriateness of the sample, respondents were screened prior to completing the questionnaire to confirm their familiarity with both digital banking services and AI-supported financial applications. This screening procedure helped ensure that participants possessed sufficient experience to meaningfully evaluate the research constructs.

The questionnaire was distributed through online channels (WhatsApp, Viber, Zalo, Facebook,…) to facilitate access to a broad and diverse population of digital financial service users. Participation was entirely voluntary, and respondents were informed that the survey was conducted solely for academic research purposes. All responses were collected anonymously, and no personally identifiable information was requested, thereby protecting participants' privacy and encouraging honest responses.

Following data collection (240 observations), the dataset was carefully screened to remove incomplete questionnaires and identify potential outliers before statistical analysis. After applying these screening procedures, 220 valid responses were retained for subsequent analysis (Achieved 91.67%). This sample size exceeds the minimum requirements recommended for Partial Least Squares Structural Equation Modeling (PLS-SEM), making it appropriate for estimating the proposed research model and testing both the direct and indirect relationships among the study constructs (Hair, Hult, Ringle, & Sarstedt, 2022).

Measurement of Constructs

All constructs were measured using established multi-item scales adapted from prior studies to ensure content validity. Minor wording modifications were made to reflect the context of AI-enabled digital financial services while preserving the original conceptual meanings. Responses were measured using a five-point Likert scale ranging from 1 ("strongly disagree") to 5 ("strongly agree"). Blockchain-based payment trust (BPT) and AI service intelligence (AISI) were specified as second-order reflective constructs, each comprising four first-order dimensions. Specifically, BPT consisted of security, transparency, immutability, and privacy protection, whereas AISI included perceived intelligence, personalization, responsiveness, and predictive capability. Customer attitude (ATT), adoption intention (AI), and technology awareness (TA) were operationalized as first-order reflective constructs. Prior to the main survey, a pilot study was conducted to assess the clarity, readability, and contextual appropriateness of the questionnaire. Based on participants' feedback, several minor wording refinements were made before the final questionnaire was administered. Details of the measurement items and their literature sources are presented in Table 1.

Table 1: Summary of measurement scales and data sources

Construct	Dimension	Item code	Measurement items	Source
Blockchain-based Payment Trust (BPT) (Second-order, reflective)	Security	BPT1	Blockchain-based payment systems are secure for financial transactions.	Kim, Ferrin, and Rao (2010) and Wang et al. (2022)
		BPT2	Blockchain-based payments protect my financial information from unauthorized access.	
	Transparency	BPT3	Blockchain-based payment transactions are transparent and verifiable.	Treiblmaier (2018)
		BPT4	I can easily trace and verify transactions made through blockchain-based payments.	
	Immutability	BPT5	Once recorded, blockchain-based payment transactions cannot be altered.	Kshetri (2018)
		BPT6	Blockchain technology ensures the integrity of payment transaction records.	
	Privacy protection	BPT7	Blockchain-based payment systems adequately protect my privacy.	Pavlou (2003) and Shahzad et al. (2023)
		BPT8	I feel confident that my personal data are protected when using blockchain-based payments.	
AI Service Intelligence (AISI) (Second-order, reflective)	Perceived intelligence	AISI1	The AI system provides intelligent solutions to my financial needs.	Rai et al. (2019)
		AISI2	The AI system is capable of learning and improving over time.	
	Personalization	AISI3	The AI-based financial service provides personalized recommendations.	Bleier, Harmeling, and Palmatier (2019)
		AISI4	The AI system tailors its services according to my preferences.	

Construct	Dimension	Item code	Measurement items	Source
	Responsiveness	AISI5	The AI system responds promptly to my requests.	Parasuraman, Zeithaml, and Berry (1988)
		AISI6	The AI service provides timely assistance when I need it.	
	Predictive capability	AISI7	The AI system anticipates my financial needs.	Davenport, Guha, Grewal, and Bressgott (2020)
		AISI8	The AI service offers useful predictions for my future financial decisions.	
Customer Attitude (ATT)		ATT1	Using AI-enabled digital financial services is a good idea.	Davis (1989)
		ATT2	I have a positive feeling toward AI-enabled digital financial services.	
		ATT3	Overall, I like the idea of using AI-enabled digital financial services.	
Adoption Intention (AI)		AI1	I intend to use AI-enabled digital financial services in the future.	Venkatesh et al. (2012)
		AI2	I plan to frequently use AI-enabled digital financial services.	
		AI3	I will continue using AI-enabled digital financial services whenever possible.	
Technology Awareness (TA)		TA1	I am familiar with emerging digital financial technologies such as AI and blockchain.	Agarwal and Prasad (1998)
		TA2	I understand how AI and blockchain technologies work in financial services.	
		TA3	I keep myself informed about new developments in digital financial technologies.	

Note: All items were measured using a five-point Likert scale ranging from 1 = strongly disagree to 5 = strongly agree. Blockchain-based payment trust and AI service intelligence were modeled as second-order reflective constructs. All measurement items were adapted from prior studies and slightly reworded to fit the context of AI-enabled digital financial services.

Common Method Bias

Because the data were collected from a single source using self-reported measures, the potential for common method bias (CMB) was assessed. Procedural remedies were implemented during questionnaire design by assuring respondent anonymity, reducing item ambiguity, and separating predictor and criterion constructs where appropriate. Statistically, Harman's single-factor test indicated that no single factor accounted for the majority of the total variance. In addition, all variance inflation factor (VIF) values were below the recommended threshold, suggesting that common method bias was unlikely to threaten the validity of the study findings.

Data Analysis Technique

PLS-SEM was employed to test the proposed research model using SmartPLS 3. PLS-SEM was considered appropriate because the proposed model incorporates second-order reflective constructs, mediation, and moderation effects, while emphasizing prediction and theory extension rather than covariance reproduction (Hair et al., 2022). Furthermore, PLS-SEM is well-suited for analyzing complex structural models without imposing stringent distributional assumptions. Following the recommended two-step analytical procedure, the measurement model was first evaluated in terms of reliability and validity, after which the structural model was

assessed to examine the proposed hypotheses, including the direct, mediating, and moderating relationships among the study constructs (Hair et al., 2022).

RESEARCH RESULTS AND DISCUSSION

Research Results

Measurement Model Assessment

The measurement model was assessed to examine the reliability and validity of the constructs prior to evaluating the structural relationships. Table 2 and Table 4 present the construct reliability and convergent validity results.

Internal consistency reliability: As shown in the results, all constructs exhibited satisfactory internal consistency reliability. Cronbach's alpha values ranged from approximately 0.83 to above 0.92, exceeding the recommended threshold of 0.70. Similarly, composite reliability values for all constructs were well above 0.90, indicating strong internal consistency and reliability of the measurement scales. Furthermore, the majority of loadings associated with individual items are greater than 0.7. These results confirm that the indicators consistently measure their respective latent constructs.

Table 2: Construct Reliability and Validity

Structure	Cronbach's Alpha	rho_A	Composite Reliability	Average Variance Extracted (AVE)
AI	0.835	0.849	0.901	0.753
AISI	0.912	0.918	0.928	0.618
AISI x TA	1.000	1.000	1.000	1.000
ATT	0.844	0.846	0.907	0.765
BPT	0.924	0.925	0.938	0.653
BPT x TA	1.000	1.000	1.000	1.000
TA	0.871	0.887	0.920	0.794

Convergent validity: Convergent validity was evaluated using the average variance extracted (AVE). The AVE values for all constructs exceeded the recommended minimum threshold of 0.50, with values ranging from approximately 0.618 to 0.794 (Table 2). This indicates that each construct explains more than half of the variance of its indicators, thereby demonstrating adequate convergent validity (Hair et al., 2022). Taken together, the reliability and convergent validity results confirm that the measurement items appropriately capture the intended constructs in the context of AI-enabled digital financial services.

Discriminant validity: Discriminant validity was assessed using the heterotrait–monotrait ratio of correlations (HTMT). All HTMT values were below the conservative threshold of 0.90, suggesting that each construct is empirically distinct from the others (Table 3). These findings indicate that the constructs used in this study capture conceptually different phenomena and that discriminant validity is well established.

Assessment of higher-order constructs: Blockchain-based payment trust (BPT) and AI service intelligence (AISI) were modeled as second-order reflective constructs. The results demonstrate that the first-order dimensions load strongly and significantly onto their respective second-order constructs, with satisfactory reliability and AVE values.

This supports the hierarchical component model specification and confirms the multidimensional nature of trust and AI service intelligence perceptions.

Overall, the measurement model demonstrates adequate reliability, convergent validity, and discriminant validity, supporting its suitability for subsequent structural model analysis.

Table 3: Heterotrait-Monotrait Ratio (HTMT)

Structure	AI	AISI	AISI x TA	ATT	BPT	BPT x TA	TA
AI							
AISI	0.884						
AISI x TA	0.197	0.175					
ATT	0.768	0.803	0.196				
BPT	0.749	0.842	0.269	0.731			
BPT x TA	0.252	0.252	0.872	0.187	0.373		
TA	0.813	0.814	0.249	0.776	0.680	0.233	

Structural Model Assessment

After establishing the adequacy of the measurement model, the structural model was evaluated to test the hypothesized relationships among the constructs.

Collinearity assessment: Collinearity was assessed by examining the variance inflation factor (VIF) values. All VIF values were below the recommended threshold of 5.0, indicating that multicollinearity is not a concern in the structural model and that the estimated path coefficients are not biased by excessive correlation among predictor variables.

Table 4: Outer loadings and collinearity statistics (VIF)

Observed Variables	AI	AISI	AISI x TA	ATT	BPT	BPT x TA	TA	VIF
AI1	0.914							2.483
AI2	0.873							2.183
AI3	0.813							1.663
AISI * TA			1.551					1.000
AISI1		0.720						3.113
AISI2		0.709						2.878
AISI3		0.801						2.909
AISI4		0.806						2.942
AISI5		0.829						2.916
AISI6		0.815						2.645
AISI7		0.804						2.738
AISI8		0.802						2.906
ATT1				0.801				1.512
ATT2				0.907				3.165
ATT3				0.911				3.189
BPT * TA						1.743		1.000
BPT1					0.856			3.411
BPT2					0.810			2.921
BPT3					0.756			2.322
BPT4					0.805			2.556
BPT5					0.805			2.732
BPT6					0.826			2.938
BPT7					0.788			2.861
BPT8					0.816			3.030
TA1							0.874	2.507
TA2							0.911	2.912
TA3							0.887	1.997

Coefficient of determination (R^2): The coefficient of determination indicates that the model explains a substantial proportion of variance in customer attitude and adoption intention. The R^2 value for customer

attitude suggests that blockchain-based payment trust and AI service intelligence jointly provide strong explanatory power. Likewise, the R^2 value for adoption intention indicates that customer attitude serves as a robust predictor of customers' intentions to adopt AI-enabled digital financial services. According to established guidelines, these R^2 values can be interpreted as moderate to substantial, demonstrating the predictive capability of the proposed research model (Table 5).

Table 5: Testing with R and R^2

Latent variable	R Square	R Square Adjusted
AI	0.666	0.665
ATT	0.667	0.659

Effect size (f^2), predictive relevance (Q^2), and SRMR: Effect size analysis indicates that both blockchain-based payment trust and AI service intelligence exert meaningful effects on customer attitude, while customer attitude shows a substantial effect on adoption intention (Table 8). This suggests that the proposed antecedents contribute meaningfully to the explanatory power of the model. In addition, the Stone–Geisser Q^2 (Table 7) values obtained through the blindfolding procedure are greater than zero for all endogenous constructs, confirming the model's predictive relevance. Additionally, the SRMR coefficient of the model (Table 6) = $0.088 < 0.1$, indicating that the overall fit of the model is acceptable, considering and suitable with the empirical data (Hu & Bentler, 1998). Taken together, the findings confirm that the PLS-SEM model provides an excellent fit to the observed data.

Table 6: Fit Summary

Structure	Saturated Model	Estimated Model
SRMR	0.078	0.088
d_ULS	1.959	2.542
d_G	1.247	1.337
Chi-Square	1286.723	1343.883
NFI	0.726	0.714

Table 7: Construct Cross-Validated Redundancy

Structure	SSO	SSE	Q^2 (=1-SSE/SSO)
AI	618.000	314.933	0.490
AISI	1648.000	1648.000	
AISI x TA	206.000	206.000	
ATT	618.000	320.761	0.481
BPT	1648.000	1648.000	
BPT x TA	206.000	206.000	
TA	618.000	618.000	

Mediation and moderation effects (brief positioning): The results further support the mediating role of customer attitude in linking technological antecedents to adoption intention. Moreover, the interaction effects involving technology awareness indicate that the relationships between technological perceptions and customer attitude vary depending on users' levels of technology awareness, providing preliminary support for the proposed moderation hypotheses.

Hypothesis Testing

To test the proposed hypotheses, a bootstrapping procedure with resampling was conducted using SmartPLS. The significance of the direct, indirect, and interaction effects was evaluated based on path coefficients (β), t-

values, and p-values. Table 8 summarizes the hypothesis testing results and Figure 2 presents the PLS-SEM model estimation results.

Direct effects: The results indicate that AI service intelligence (AISI) has a strong and positive effect on customer attitude (β = 0.634, t = 7.101, p < 0.001), providing strong support for H2. This finding suggests that customers who perceive AI-enabled financial services as intelligent, responsive, and predictive are more likely to develop favorable attitudes toward such services. In contrast, the effect of blockchain-based payment trust (BPT) on customer attitude is positive, but not statistically significant (β = 0.084, t = 0.945, p = 0.345). Blockchain-based payment trust did not significantly influence customer attitude; therefore, H1 was not supported. Furthermore, customer attitude (ATT) exhibits a very strong and significant effect on adoption intention (β = 0.816, t = 28.028, p < 0.001), thereby supporting H3. This highlights customer attitude as the most critical predictor of adoption intention toward AI-enabled digital financial services.

Moderating effects of technology awareness: The moderating role of technology awareness (TA) was examined through interaction terms. The results show that the interaction effect between AI service intelligence and technology awareness (AISI × TA) on customer attitude is not statistically significant (β = −0.079, t = 0.610, p = 0.542). Thus, H5b is not supported. Similarly, the interaction between blockchain-based payment trust and technology awareness (BPT × TA) does not have a significant effect on customer attitude (β = 0.082, t = 0.613, p = 0.540), leading to the rejection of H5a. Interestingly, the direct effect of technology awareness on customer attitude is marginally significant (β = 0.162, t = 1.858, p = 0.063), suggesting that technology awareness may function more effectively as an independent antecedent rather than as a moderator in the proposed model.

Mediation effects: The mediating role of customer attitude was examined by analyzing the specific indirect effects using bootstrapping. The indirect effect of AI service intelligence on adoption intention via customer attitude is positive and statistically significant (β = 0.517, t = 6.969, p < 0.001), supporting H4b. This result indicates that customer attitude fully or partially mediates the relationship between AI service intelligence and adoption intention. In contrast, the indirect effect of blockchain-based payment trust on adoption intention via customer attitude is not statistically significant (β = 0.068, t = 0.940, p = 0.347). Accordingly, H4a is not supported. Additionally, the indirect effects involving interaction terms (AISI × TA → ATT → AI and BPT × TA → ATT → AI) are also non-significant, further confirming the absence of moderating effects through customer attitude.

Summary of hypothesis testing results: Overall, the results provide strong empirical support for the central role of AI service intelligence and customer attitude in driving adoption intention toward AI-enabled digital financial services. While blockchain-based payment trust does not exert a significant direct or indirect effect in the proposed model, technology awareness appears to influence customer attitude directly rather than moderating technological relationships.

Table 8: Summary of hypothesis testing results

Hypothesis	Path	f^2	β	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values	Result
H1	BPT → ATT	0.008	0.084	0.088	0.945	0.345	Not supported
H2	AISI → ATT	0.361	0.634	0.089	7.101	0.000	Supported
H3	ATT → AI	1.997	0.816	0.029	28.028	0.000	Supported
H4a	BPT → ATT → AI		0.068	0.073	0.940	0.347	Not supported
H4b	AISI → ATT → AI		0.517	0.074	6.969	0.001	Supported
H5a	BPT x TA → ATT	0.013	0.082	0.134	0.613	0.540	Not supported
H5b	AISI x TA → ATT	0.010	-0.079	0.129	0.610	0.542	Not supported

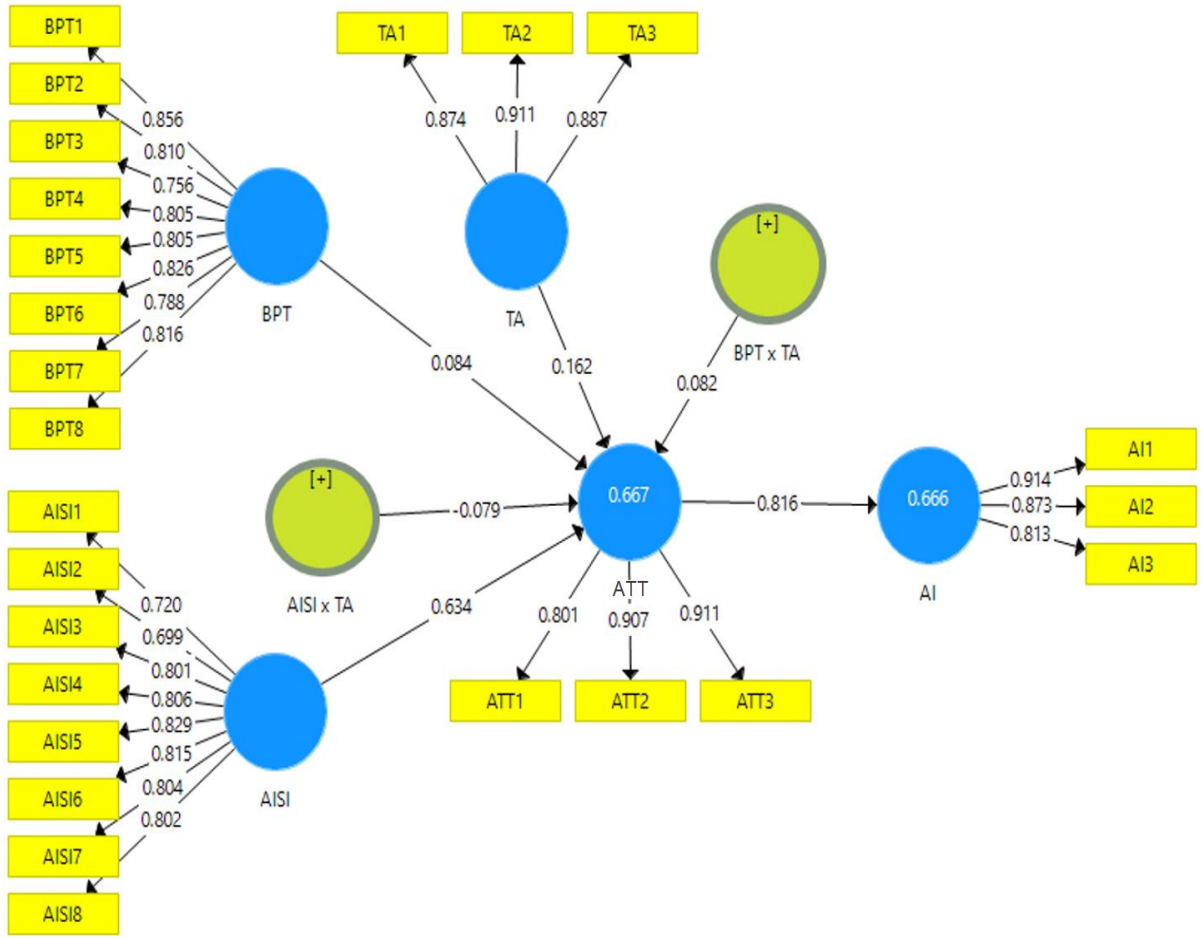

Figure 2: PLS-SEM model estimation results

Discussion

The findings provide new insights into customer adoption of AI-enabled digital financial services by clarifying the distinct roles of AI service intelligence and blockchain-based payment trust within an integrated technological ecosystem. AI service intelligence emerged as the strongest determinant of customer attitude, confirming that intelligent service capabilities, including personalization, responsiveness, predictive capability, and perceived intelligence, play a central role in shaping customers' evaluations of AI-enabled financial services. This finding supports previous studies highlighting AI as a value-creating service capability rather than merely an automation technology (Huang & Rust, 2021; Rai et al., 2019). More importantly, the present study extends existing literature by showing that when AI and blockchain coexist within the same financial ecosystem, customers place greater emphasis on intelligent service experiences than on the underlying technological infrastructure. This suggests that AI-driven service capabilities have become the primary source of perceived value in contemporary digital financial services.

In contrast, blockchain-based payment trust did not significantly influence customer attitude, indicating that trusted payment infrastructure alone may not be sufficient to shape customers' evaluations of AI-enabled financial services. Rather than interpreting this finding as evidence that blockchain trust is unimportant, the results are consistent with the view that payment trust functions as a foundational condition that customers increasingly take for granted in mature digital financial environments.

Once an acceptable level of security, transparency, and privacy protection has been established, customers appear to differentiate financial services primarily through the quality of AI-enabled service experiences rather than payment infrastructure alone (Pavlou, 2003; Shahzad et al., 2023). The study also confirms the central mediating role of customer attitude in translating AI service intelligence into adoption intention. Consistent with technology acceptance theory (Davis, 1989; Venkatesh et al., 2003; Venkatesh et al.,

2012), customers' behavioral intentions are influenced not only by technological capabilities but also by their overall evaluations of those capabilities. Interestingly, customer attitude did not mediate the relationship between blockchain-based payment trust and adoption intention, further suggesting that trust, although essential, may not independently motivate adoption when intelligent service capabilities dominate customers' decision-making. Finally, technology awareness did not significantly moderate the relationships between either blockchain-based payment trust or AI service intelligence and customer attitude. This finding suggests that well-designed AI-enabled financial services can deliver positive customer experiences regardless of users' technological knowledge. In other words, customers appear capable of appreciating intelligent service features without requiring a deep understanding of the underlying AI or blockchain technologies. This result challenges the assumption that greater technology awareness necessarily strengthens customers' evaluations of emerging financial technologies and instead highlights the importance of intuitive and user-centered service design.

Overall, the findings contribute to technology adoption research by demonstrating that customer adoption of AI-enabled digital financial services is primarily driven by AI-enabled service value rather than infrastructure-level trust. The study further highlights customer attitude as the principal psychological mechanism linking technological capabilities with adoption intention, while suggesting that technology awareness plays a less influential role than previously assumed in contemporary AI-enabled financial ecosystems.

MANAGERIAL IMPLICATIONS AND CONCLUSION

Managerial Implications

Based on the empirical findings, this study offers differentiated managerial implications for key stakeholders in the digital financial ecosystem, including traditional banks, fintech firms, and policymakers.

Implications for traditional banks: For traditional banks, the findings highlight the need to redefine competitive advantage in the era of AI-enabled digital finance. While banks typically invest heavily in secure payment infrastructures and regulatory compliance, the results suggest that infrastructure-level trust is increasingly perceived as a basic requirement rather than a source of differentiation. Bank managers should therefore shift strategic focus toward AI-driven service intelligence to enhance customer attitudes and adoption intentions.

Specifically, banks should: (1) Invest in AI systems that deliver personalized financial advice, proactive alerts, and predictive insights tailored to customers' financial behaviors; (2) Embed AI capabilities into existing digital channels (e.g., mobile banking apps) to improve responsiveness and real-time support; and (3) Design AI interfaces that are transparent and explainable, helping customers feel comfortable and confident when interacting with intelligent financial systems. By doing so, banks can leverage their existing trust capital as a foundation while competing more effectively on customer experience and service intelligence.

Implications for fintech firms: For fintech firms, the findings provide strong validation for AI-first business models. The dominant role of AI service intelligence indicates that fintech adoption is driven primarily by customers' perceptions of intelligent, adaptive, and value-adding services rather than by infrastructural trust mechanisms alone.

Fintech managers should consider the following strategic directions: (1) Prioritize AI capabilities as the core value proposition, particularly in areas such as automated financial recommendations, real-time risk assessment, and predictive analytics; (2) Simplify customer interactions by leveraging AI-driven personalization and natural language interfaces, reducing cognitive and technological barriers for users with lower technology awareness; and (3) Treat blockchain-based trust as a backend enabler, ensuring secure and transparent transactions without overemphasizing technical blockchain features in customer-facing communication. This approach allows fintech firms to scale rapidly while maintaining a strong focus on user-centric innovation.

Implications for policymakers and regulators: For policymakers and regulatory authorities, the findings underscore the importance of balancing innovation with baseline trust and accountability in AI-enabled financial services. Since trust functions as a foundational condition rather than a primary adoption driver,

regulatory frameworks should focus on ensuring minimum trust standards while enabling innovation in AI-driven services. Key policy implications include: (1) Establishing clear guidelines on data protection, privacy, and algorithmic accountability to ensure that trust remains embedded in digital financial systems; (2) Encouraging the development of ethical and explainable AI standards to reduce concerns related to algorithmic opacity and automated decision-making; and (3) Supporting innovation sandboxes and pilot programs that allow banks and fintech firms to experiment with AI-enabled services under regulatory supervision. By providing regulatory clarity and flexibility, policymakers can foster an environment that promotes responsible innovation while protecting consumer interests.

Implications for ecosystem collaboration: Beyond individual stakeholder groups, the findings also suggest the importance of collaboration across the financial ecosystem. Banks, fintech firms, and regulators should work together to create integrated platforms where secure blockchain-based infrastructures support intelligent AI-driven services. Such collaboration can accelerate the diffusion of AI-enabled digital financial services while ensuring that trust, transparency, and customer-centric value creation are aligned across the ecosystem.

Conclusion

This study examined customer adoption of AI-enabled digital financial services by integrating blockchain-based payment trust and AI service intelligence within a unified research framework. Based on survey data from 220 users and analyzed using PLS-SEM, the findings demonstrate that AI service intelligence is the primary driver of customer attitude, which subsequently promotes adoption intention.

Contrary to conventional assumptions, blockchain-based payment trust does not exert a significant direct or indirect effect on customer attitude or adoption intention when AI service intelligence is taken into account. This result suggests that, in contemporary digital financial environments, trust-related technological infrastructures may function as baseline conditions rather than differentiating adoption drivers. These findings are consistent with the view that trust-related technological infrastructures may increasingly function as foundational conditions rather than primary drivers of customer adoption. Furthermore, the results highlight customer attitude as a key mediating mechanism, emphasizing the importance of affective and evaluative responses in AI-enabled financial service adoption.

By demonstrating the dominant role of AI service intelligence and the evolving function of trust, this study advances theoretical understanding of technology adoption in integrated AI–blockchain financial ecosystems and offers actionable insights for financial institutions, fintech firms, and policymakers.

Limitations and future research directions: Despite its contributions, this study has several limitations that provide opportunities for future research. First, the cross-sectional research design limits the ability to capture changes in customer perceptions over time. Future studies could employ longitudinal designs to examine how trust and AI service intelligence evolve as users gain experience with AI-enabled financial services. Second, the data were collected from a single national context, which may limit the generalizability of the findings.

Comparative studies across countries or financial markets could offer deeper insights into cultural and institutional influences on AI and blockchain adoption. Third, this study focused primarily on adoption intention rather than actual usage behavior. Future research could extend the model by incorporating usage frequency, continuance intention, or objective behavioral data to validate the robustness of the proposed relationships. Finally, while technology awareness did not function as a moderator in this study, future research may explore alternative contingent factors, such as perceived algorithmic transparency, trust in AI decision-making, or regulatory trust to further refine understanding of customer adoption in AI-enabled digital finance.

FUNDING: There is no funding available for this research.
INSTITUTIONAL REVIEW BOARD STATEMENT: This study was approved by the Faculty of International Trade, Van Hien University, Vietnam, under protocol number [01/ETH-INT]. Informed verbal consent was obtained from all participants, and all data were anonymized to protect participant confidentiality.
TRANSPARENCY: The authors confirm that the manuscript is an honest, accurate, and transparent account of the study; that no vital features of the study have been omitted; and that any discrepancies from the study as planned have been explained. This study followed all ethical practices during writing.
COMPETING INTERESTS: The authors declare that they have no competing interests.
AUTHORS' CONTRIBUTIONS: All authors contributed equally to the conception and design of the study. All authors have read and agreed to the published version of the manuscript.
DISCLOSURE OF AI USE: The authors used OpenAI's ChatGPT to assist with improving the academic writing, language clarity, logical organization, and readability of the manuscript during the revision process. The AI tool was not used for data collection, data analysis, interpretation of results, or drawing scientific conclusions. All AI-generated suggestions were critically reviewed, verified, and substantially revised by the authors, who take full responsibility for the final content of the manuscript.

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