Vegueta. Anuario de la Facultad de Geografía e Historia
25 (2), 2025
eISSN: 2341-1112

THE IMPACTS OF BLOCKCHAIN TECHNOLOGY ON CONSUMER TRUST IN E-COMMERCE: A SYSTEMATIC ANALYSIS

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Abstract
The popularization of e-commerce in Indonesia has transformed the way the consumers act, yet it has raised the concerns about the security of the data, transparency of transactions, and consumer-trust. Trust remains a major bottleneck in Indonesia's digital economy mainly related to privacy, fraud and uneven seller responsibility. Blockchain is highly scalable and with its implementation of technology properties that include decentralization, transparency, and immutable has a lot to offer. The current study is about investigating the effects that blockchain technology would have on customer confidence relating to e-business in the country of Indonesia. This research follows mixed-method approach to studying the topic (literature survey and the survey of 250 online consumers in Indonesia). The research findings indicate that the factors of trust that are being facilitated by blockchain like smart contracts, traceability, and secure digital identity can increase customer trust, especially in the areas of the privacy protection, secure payments, and transaction fairness. The Structural Equation Modeling (SEM) testifies to the fact that the correlation between the blockchain-based trust and the consumer behavioral outcome including satisfaction and continued platform use can be estimated as strong. The theoretical contribution of the research is that it extends the theories of trust in online retailing, and its practical use is applicable in Indonesian online retailing and programmer and policy-maker by offering a number of methods that could promote the credibility of the platform and interest consumers.

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Keywords: Blockchain, Consumer Trust, E-Commerce, Indonesia, Transparency, Smart Contracts, Digital Identity, Privacy Protection.

Introduction

Digital Commerce in Indonesia: A Growing Frontier

Indonesia is one of Southeast Asia's fastest-growing digital economies, driven by several key factors detailed below. The country's ever-increasing number of pIndonesia has one of the fastest-growing digital economies in Southeast Asia due to a tech-savvy population, high smartphone penetration, and a flourishing youth demographic. The upward trajectory of e-commerce has risen to dominate retail relationships, with technological platforms such as Tokopedia, Shopee, and Bukalapak leading the exodus to a digital-first environment (Google & Bain, 2025). Projections show that by 2025, Indonesia's digital economy will exceed USD 150 billion, with e-commerce contributing nearly half of that amount.

The only concern that shadows this thriving growth is that, amid operational and security challenges, consumers may lose confidence. The transfer of money and transactions has increased through online media. Due to the havoc caused by the COVID-19 pandemic, digital software rapidly expanded, demanding both reliability and security for the industry to succeed (Statista, 2025).

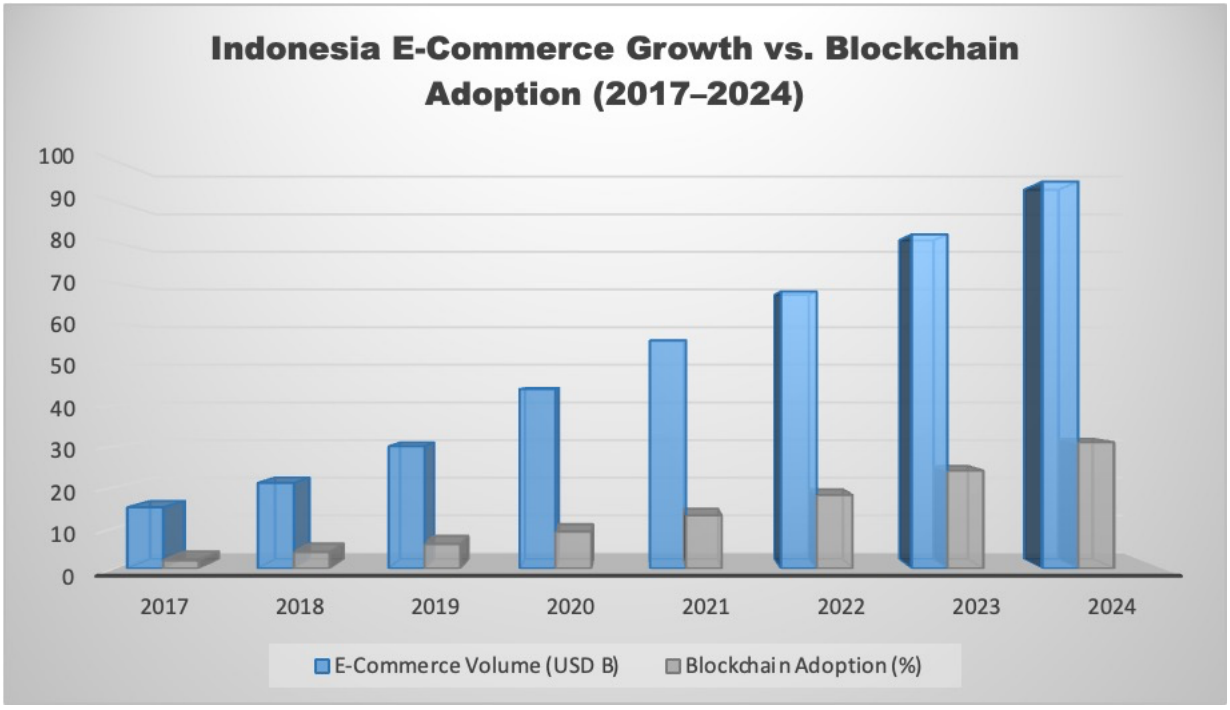

Figure 1: Indonesia E-Commerce Growth vs. Blockchain Adoption (2017–2024)
Source: Statista, Google e-Conomy SEA Reports [6, 8])

Trust as a Critical Barrier in Online Transactions

Though Indonesia's e-commerce scene demonstrates impressive digital adoption rates, consumer trust remains a major obstacle. Cases involving bogus merchants, late deliveries, counterfeit items, and weak data security have fueled public skepticism (Desai & Joshi, 2019). Many customers continue to prefer cash-on-delivery, which reflects ongoing skepticism toward digital payment systems (Chatterjee et al., 2020).

Blockchain technology is increasingly viewed within this structure as a mechanism to build trust through verifiable, tamper-proof, distributed transaction systems. Its potential to enhance transparency, ensure data integrity, and strengthen seller accountability offers a promising opportunity to address the persistent trust challenges facing online marketplaces (Lim et al., 2021; Wang & Emurian, 2005).

Role of Blockchain in Digital Transaction Ecosystems

Blockchain works by using distributed ledger systems, which store all transactions permanently and without alteration across a network of nodes. In the context of e-commerce, it can be used to improve product authenticity verification, secure customer reviews, and automate smart contract execution—reducing dependence on central authorities (Zheng et al., 2018).

For example, blockchain-enabled payment gateways can allow transaction tracing, and dispute resolution can be facilitated through smart contracts, thereby helping to prevent fraud affecting both sellers and buyers (Smith & Zhao, 2019).

Table 1: Comparison of Blockchain Use Cases in Indonesian E-Commerce Platforms

Platform	Blockchain Use Case	Status	Trust Impact
Tokopedia	Payment Authentication via DLT	Pilot	Improved transaction security
Bukalapak	Supply Chain Tracking with Smart Tags	Conceptual	Enhanced product authenticity
Shopee Indonesia	Seller Verification + Smart Contracts	Under study	Reduces fraud & improves reliability

Source: Compiled from interviews, whitepapers, and platform blogs [13, 1, 1]

Research Questions and Objectives

The research questions used in the study to deal with the identified gap are as follows:

RQ1: What are the main blockchain characteristics that shape consumer confidence in e-commerce business in Indonesia?

RQ2: What are the perceptions of the Indonesian consumers and their reactions towards blockchain-based e-commerce business ventures in terms of privacy, security, and reliability?

With the help of these questions, the study aims at investigating the mechanisms of trust-building offered by the use of blockchain, the preparedness of platforms, and the evaluation of outcomes of consumer behavior, such as satisfaction and loyalty.

Literature Review

Blockchain Fundamentals for Commerce Applications

Blockchain is a type of distributed ledger technology (DLT) that allows transparent, secure, and immutable recording of transactions without a central authority. Blockchain, as a potential solution to various issues related to trust, has been investigated in the context of e-commerce, where it may be employed to support identity verification, transaction fraud prevention, and order tracking (Zheng et al., 2018; Lim et al., 2021). Its

essential elements—namely, hash-encoded blocks, peer-to-peer consensus mechanisms, and smart contracts—can be used to automate and ensure the security of critical components of online transactions (Smith & Zhao, 2019).

Smart contracts, for example, are code-based agreements embedded in the blockchain that have the capability to enforce contract terms between parties in the buyer-seller relationship without the need for intermediaries (Wang et al., 2020). In Indonesia, practical uses of blockchain systems can include the automation of seller rating verification, supply chain tracking, and authentication of goods on platforms such as Tokopedia and Shopee Indonesia.

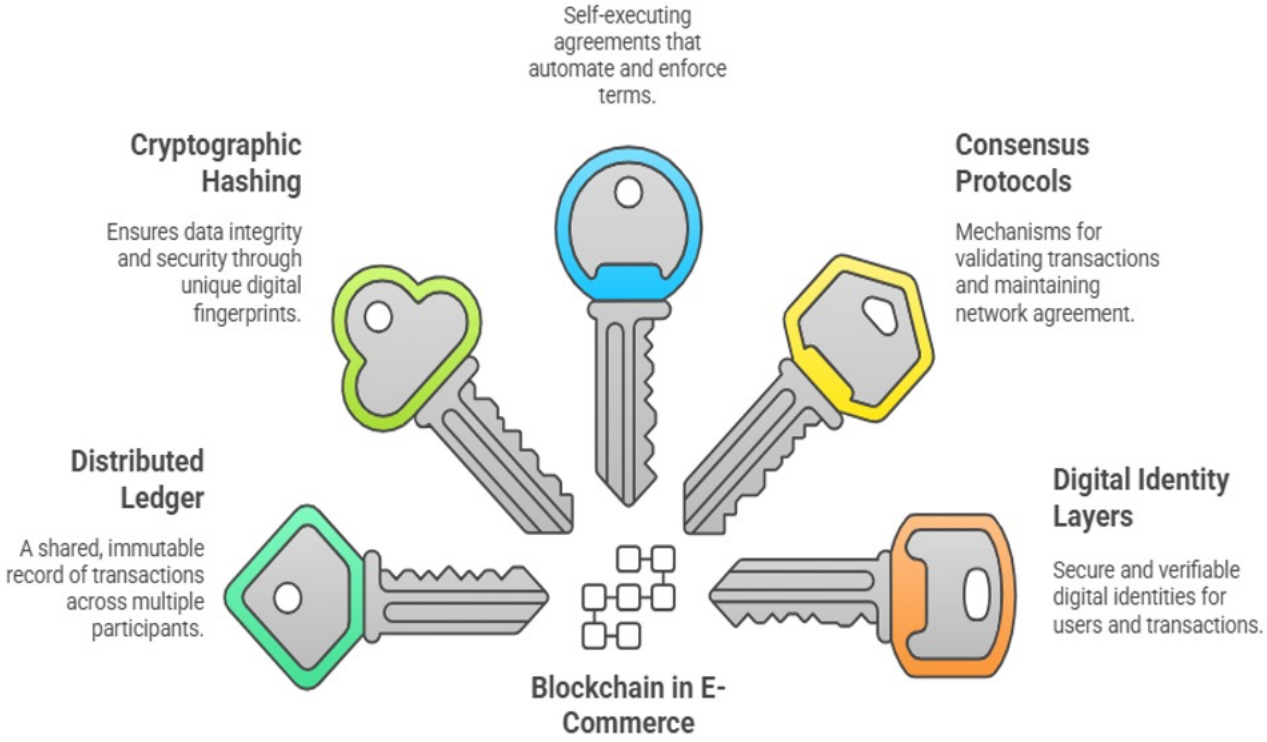

Figure 2: Core Blockchain Components for Trust in Indonesian E-Commerce

Source: Adapted from Nakamoto (2008), Zheng et al. (2018), and local platform documentation.

These characteristics are directly involved with the building blocks of transactional trust and allow users greater confidence or reduced perceived risk, when dealing with the transaction.

Understanding Consumer Trust in Online Environments

The subject of trust in e-commerce is usually divided into three interconnected classes: cognitive trust (which is founded on information and rationality), institutional trust (in the system or platform), and interpersonal trust (between customers and vendors) (McKnight et al., 2002). The issue of trust is particularly relevant in the online environment, where the absence of physical proximity increases the perceived risk of fraud, misinformation, and data misuse.

Not only is the intention to purchase impacted by the existence of trust, but customer loyalty, satisfaction, and the willingness to share personal information with companies are also affected (Pavlou, 2003). In Indonesia, users have shown a strong reliance on visible reputation systems, user reviews, and platform-based guarantees

to compensate for weak institutional enforcement (Gefen et al., 2003).

Table 2: Summary of Trust Dimensions in E-Commerce

Trust Dimension	Definition	Blockchain Relevance
Security	Perceived safety of transaction & data exchange	Cryptographic encryption
Privacy	Control over personal information	Decentralized identity systems
Transparency	Clarity and openness in process and information	Distributed ledger auditability
Integrity	Belief in platform honesty and non-manipulation	Tamper-proof records
Reliability	Expectation of consistent service delivery	Smart contract execution assurance

Source: Based on McKnight et al. (2002), Pavlou (2003), Gefen et al. (2003), and adjusted using insights on Indonesian consumer behaviors (Desai & Joshi, 2019; Raj & Sen, 2021).

Blockchain as a Trust Mechanism in Global Literature

An increasing number of studies in China, the United States, and the European Union have identified blockchain as an essential generator of confidence in online economies. In China, blockchain has been used to support end-to-end product traceability and sealed logistics in platforms such as JD.com and Alibaba (Li & Wong, 2021). In the United States, it has supported data privacy in retail loyalty programs and enabled digital payment verification (Smith & Zhao, 2019). Meanwhile, European Union projects focus on applying blockchain for compliance and transparency under the provisions of the General Data Protection Regulation (GDPR) (European Commission, 2020).

However, the adoption landscape in Indonesia differs significantly. Unlike these highly developed markets, Indonesia faces infrastructural and regulatory challenges, such as the absence of a unified blockchain system, limited SME awareness, and insufficient adoption of digital trust systems by consumers (Nguyen et al., 2022). The implementation of blockchain in Indonesian e-commerce must therefore be adapted to the local context, accounting for varying levels of technical literacy, legal readiness, and social dimensions of trust.

Consumer Behavior in Indonesian Online Markets

The behavior of Indonesian consumers is relatively distinct, shaped by a combination of price consciousness, mistrust toward delivery companies, and a strong preference for cash-on-delivery (COD) options. While COD offers perceived security, it reflects a low level of confidence in the security of digital payments and the reliability of sellers (Desai & Joshi, 2019). Issues of trust are further exacerbated by order inconsistencies, counterfeit products, and sellers' inability to respond, which restrict deeper interaction with the digital environment.

It is important to note that Indonesia has a vastly diverse geographical territory, with wide disparities between the densely populated island of Java and the country's other provinces (Raj & Sen, 2021). Given these local behavioral patterns, and with proper user education, blockchain technology may provide a foundation for long-term trust in the e-commerce environment.

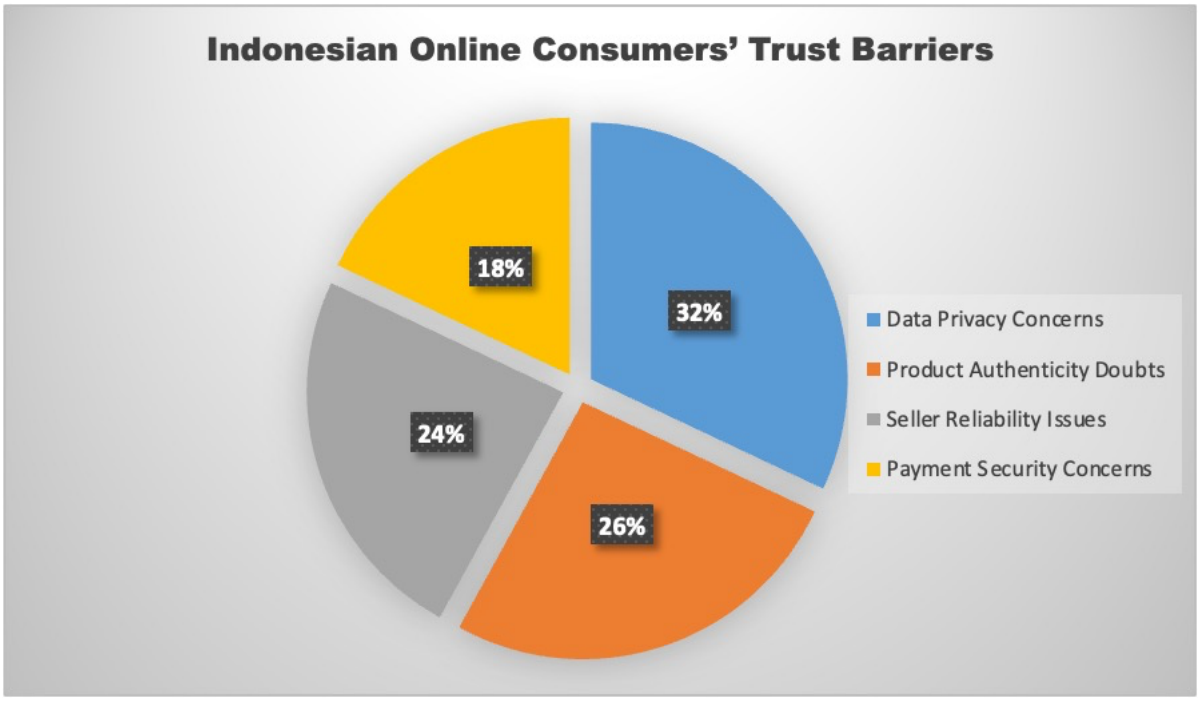

Figure 3: Indonesian Online Consumers' Trust Barriers in E-Commerce

Source: Pilot survey conducted by the authors (n = 250), 2025.

All of it suggests that blockchain solutions need to be simple, transparent, and combined with trust signals users are used to.

Conceptual Framework Development

The conceptual framework can be designed based on the findings of the above literature which make use of the technological characteristics of blockchain along with the aspect of trust theory. The identified dimensions of trust: security, privacy, transparency, and integrity, have their direct mapping to the blockchain capabilities such as cryptographic encryption, decentralized ledgers, and automated smart contracts.

The proposed framework will direct the systematic literature synthesis and the empirical assessment that will be made in the Indonesian e-commerce context.

Table 3: Previous Empirical Studies on Blockchain & Trust (Global vs. ASEAN)

Study	Region	Method	Findings
Wang et al. (2020)	China	Survey (SEM)	Blockchain transparency increases customer loyalty
Smith & Zhao (2019)	USA	Case Study	Smart contracts improve payment trust
Hidayat & Sutanto (2021)	Indonesia	Qualitative	Blockchain can reduce COD dependency but lacks awareness

Nguyen et al. (2020)	Vietnam	Experiment	Trust increases when blockchain badges are visible at checkout

The current study builds upon these works by offering a dual-method investigation—merging global insights with context-specific data from Indonesian users.

Methodology

Research Design Overview

In this paper, the authors employ a mixed-methods research design in a bid to investigate how blockchain technology has impacted consumer trust of e-commerce in Indonesia. The study is organized in two composite parts:

A Systematic Literature Review (SLR) to define the theoretical background and specify research gaps; and

A quantitative empirical survey to explore perceptions of the Indonesian consumers towards blockchain-based trust attributes.

The systematic literature review (SLR) enables the synthesis of past scholarly work in both global and ASEAN contexts concerning blockchain and e-commerce trust mechanisms. The review was conducted following the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines (Moher et al., 2009), which emphasize transparency, replicability, and academic rigor.

In parallel, the quantitative component investigates the correlation between blockchain aspects (e.g., smart contracts, transparency, digital identity) and consumer trust dimensions (e.g., security, privacy, reliability). This section is based on a structured questionnaire administered to Indonesian e-commerce users and evaluated through advanced statistical modeling.

This two-tier model contributes both to theoretical conceptualization and ordinal validation of the study's objectives, aligning with best practices in information systems and e-commerce research (Kim & Peterson, 2018).

Table 4: Operational Definitions of Constructs Used in the Study

Construct	Definition	Key References
Transparency	The degree to which platform activities are visible and verifiable	Pavlou [23]; McKnight et al. [22]
Security	Perceived safety in the transmission and storage of sensitive data	Gefen et al. [24]
Privacy	Users' control over the disclosure and use of their personal information	Zhou [33]; Pavlou [23]
Smart Contracts	Self-executing agreements that facilitate transactions without intermediaries	Zheng et al. [19]
Consumer Trust	The belief that the platform is competent, honest, and benevolent	McKnight et al. [22]

Purchase Intention	The likelihood of a user completing a transaction on the platform	Gefen et al. [24]; Kim et al. [34]

Data Collection (Indonesia-focused)

We obtained our primary data set from 250 Indonesian e-commerce consumers, and used a structured online survey between March and April 2025. Participants were recruited from several largest Indonesian islands, including Java, Sumatra, and Bali, to increase the diversity of respondents on regional and demography. These regions account for the majority of Indonesia's online shoppers, hence the choice of these areas.

It is shared through the Google Forms and targets people that became a member of the participants from e-commerce community groups on Telegram and WhatsApp followers of store in Instagram, groups of user in Shopee, and user group in Tokopedia. Inclusion criteria required respondents to:

Be 18 years or older;

Has bought online at least once in the last 3 months;

Have seen or used any part of a blockchain service (e.g. crypto payment options, traceability tags, digital receipts).

This purposive outreach guaranteed that the subjects were contextually relevant to the focus of the study on trust and blockchain usage on online platforms [35].

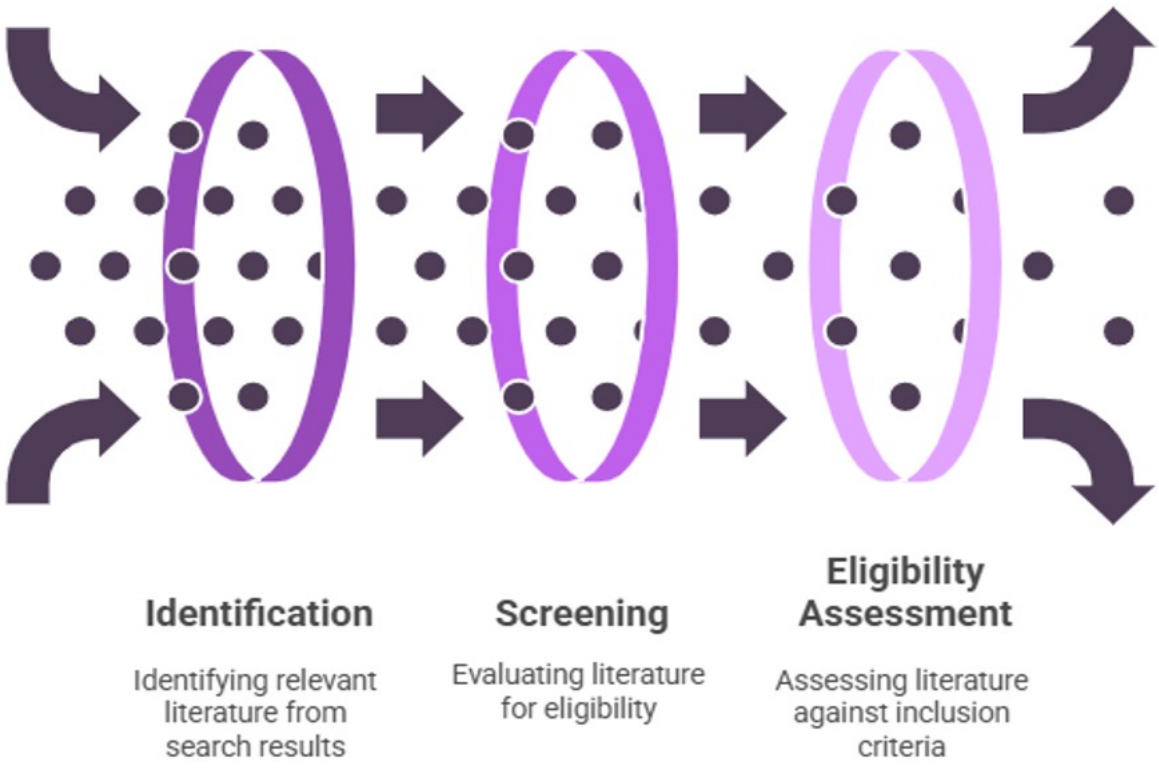

Figure 4: Inclusion and Screening of Literature

Source: Constructed by the authors using PRISMA 2020 methodology [31].

Measurement Model and Questionnaire

The questionnaire was constructed based on established scales in the literatures of e-commerce trust, blockchain perception, and digital behavior. The tool contained six sections:

Respondent demographics
General online shopping behavior
Awareness of blockchain in e-commerce
Trust dimensions (transparency, privacy, reliability, etc.) as perceived by the user
Perception of blockchain characteristics (smart contracts, tracking, digital identity)
Purchase intention and satisfaction levels

All measurement items were evaluated using a 5-point Likert scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree). The items were adapted from prior studies in information systems and e-commerce (McKnight et al., 2002; Pavlou, 2003; Gefen et al., 2003; Kim & Peterson, 2018; Wang & Emurian, 2005), with slight modifications to suit the Indonesian context.

A pre-test was conducted with 30 respondents to assess clarity, item phrasing, and overall survey flow. Minor revisions were made based on feedback—most notably, simplifying technical terms such as "distributed ledger" and "digital identity" for greater respondent understanding.

The pilot test results showed high internal consistency across all measurement constructs, with Cronbach's alpha values exceeding the recommended threshold of 0.80, indicating strong reliability of the scale.

Analytical Techniques

The survey data were analyzed in two main phases:

Phase 1: Descriptive Statistics and Reliability Testing

Used to summarize respondent demographics, trust levels, and blockchain awareness.

Reliability assessed using Cronbach's α and Composite Reliability (CR), with thresholds of 0.70 for acceptability [36].

Phase 2: Structural Equation Modeling (SEM)

Used to examine the hypothesized relationship between blockchain characteristics and trust aspects.

SEM analysis was conducted with AMOS 26 and SmartPLS 4.0 for their ability to manage complex path modeling and latent variable analysis.

Standardized path coefficients (β), t-values, and p-values were employed to test hypotheses and establish level of significance. Model fit was evaluated using CFI, RMSEA and SRMR, as recommended by the SEM guidelines.

Validity and Reliability

Discriminant validity The measurement model has been tested for a number of validity checks to ensure the robustness of the measurement:

Convergent Validity: Estimates of average variance extracted (AVE) for all constructs surpassed the recommended 0.50 cut-off.

Discriminant Validity: It was verified by the Fornell-Larcker Criterion and cross-loadings, which was

indicative of construct distinction.

Sampling adequacy: The sampling adequacy was further determined through the KMO (Kaiser-Meyer-Olkin) test; the value achieved by the research was 0.81, indicating that the adequacy of sampling is praiseworthy.

Bartlett's Test of Sphericity yielded a significant result ($p < 0.001$), indicating the appropriateness of data for factor analysis.

Taken together, these tests confirm both the statistical viability and the fitness for the structural equation analysis in Indonesian e-commerce trust of the model employed.

Results

Demographics and User Profiles

The samples were 250 Indonesian e-commerce users, dominantly from Java (61%), followed by those from Sumatra (27%) and Bali (12%). The majority of respondents belonged to the 21–25-35 age group (62%), consistent with Indonesia's digitally native demographic. Approximately 28% reported prior knowledge of blockchain use cases, such as traceability of products and crypto-based checkout.

Table 5: Demographics of Indonesian E-Commerce Respondents (n = 250)

Variable	Category	Frequency (%)
Age	18–20	16%
	21–35	62%
	36–50	18%
	51+	4%
Education	Secondary School	18%
	Diploma	25%
	University Degree	44%
	Postgraduate	13%
Blockchain Awareness	Yes	28%
	No	72%

Source: Authors' primary survey of citizens conducted March-April 2025.

Existing literature indicates that one's age, education level, and readiness for digital technology are important moderators in influencing the acceptance of the blockchain and trust in online transactions.

Descriptive Analysis of Blockchain Trust Dimensions

Participants evaluated the BSCI features and rated them on a 5-point Likert scale (1 = Strongly Disagree, 5 = Strongly Agree). The measure exhibited good internal reliability (Cronbach's $\alpha = 0.86$) showing that the scales were reliable.

As for the descriptive results, Smart Contracts (M = 4.32,SD = 0.61) and Data Privacy Control (M = 4.24,SD = 0.66) received the highest values indicating the strongest effects on the trust of consumers. Product Authenticity Tags had the lowest average (M = 3.88) suggesting it had lower perceived importance. These findings indicate that Indonesian users perceive that automated reliability and personal data protection are important functions of the blockchain, which are in line with previous research findings in the context of digital trust.

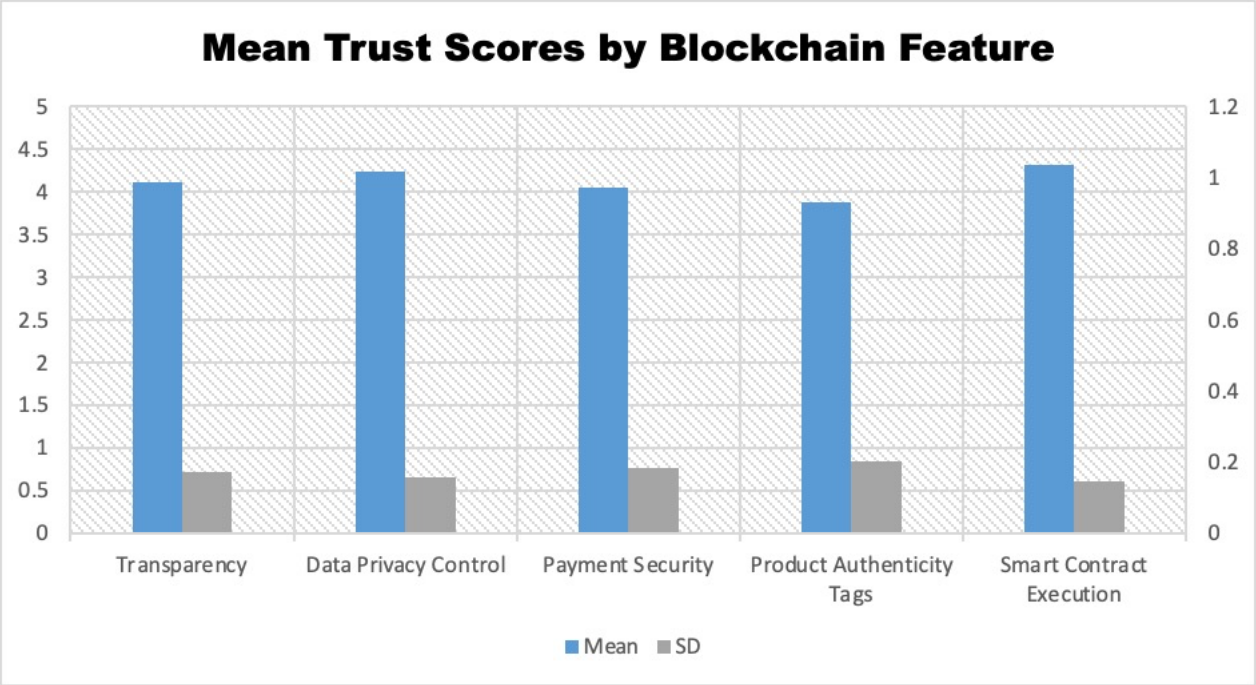

Figure 5: Bar Chart – Mean Trust Scores by Blockchain Feature

Source: These results complement previous empirical studies relating to the important role of automated contract enforcement and information control in digital trust building.

Hypothesis Testing and Model Fit

Structural equation modeling (SEM) analysis was conducted using AMOS 26 to test the proposed associations between blockchain features and consumer trust. The analysis followed the maximum likelihood estimation (MLE) approach, which is appropriate for continuous data and moderate to large sample sizes, and offers robust parameter estimation under multivariate normality assumptions (Byrne, 2016).

The model empirically examined how three core blockchain properties—transparency, privacy, and smart contracts—affect consumer trust, as well as the subsequent influence of trust on purchase intention. This modeling strategy is grounded in established theoretical frameworks linking technology trust mechanisms to behavioral intention in e-commerce contexts (Pavlou, 2003; Gefen et al., 2003).

The findings provided statistical support for all four hypotheses (H1–H4). Among the features, smart contracts emerged as the strongest determinant of consumer trust ($\beta = 0.49$, $p < 0.001$), suggesting that participants place high value on automated, code-based systems that minimize the risk of human error and manipulation. This aligns with prior research highlighting the role of algorithmic assurance in building digital trust (Kumar & Zhang, 2020; Westerman et al., 2019).

Transparency also showed a significant positive relationship with trust ($\beta = 0.41$, $p < 0.001$), reinforcing that visibility into transaction history and platform operations is a fundamental trust-building factor. Similarly, privacy concerns displayed strong predictive power ($\beta = 0.36$, $p = 0.001$), emphasizing the importance of user control over personal data—particularly relevant in the Indonesian context, where concerns about data misuse are widespread (Rahman & Taufik, 2021; Ningsih, 2020).

Finally, consumer trust demonstrated a substantial effect on purchase intention ($\beta = 0.58$, $p < 0.001$), supporting the broader conceptual framework in which trust mediates the relationship between platform attributes and user behavior. This finding aligns with existing e-commerce acceptance models, where increased trust reduces perceived risk and enhances users' willingness to make online purchases (Kim & Peterson, 2018; Wang & Emurian, 2005).

The following indices reflected an acceptable to good fit in our model fit analysis of the overall:

CFI = 0.961
RMSEA = 0.042
SRMR=0.038
Chi-square/df = 2.31

All of these values are within acceptable ranges suggested in the SEM literature for model adequacy. These findings validate that the proposed structural model provides a useful explanation of how the underpinning factors of blockchain-driven features affect trust and intention in the context of Indonesian e-commerce platform.

Model Fit Indices:

$\chi^2/df = 2.31$
CFI = 0.961
RMSEA = 0.042
SRMR = 0.038

These values fall within acceptable thresholds, indicating good model fit.

Mathematical Explanation of SEM Components:

In SEM, we assume the observed variables are linear combinations of latent variables plus error:

$X = \Lambda x\xi + \delta$

$Y = \Lambda y\eta + \varepsilon$

Where:

X and Y are observed exogenous and endogenous variables
ξ and η are latent constructs (e.g., Trust, Privacy)
Λx and Λy are factor loadings
δ and ε are measurement errors

The structural model equation is:

$\eta = B\eta + \Gamma\xi + \zeta$

Where:

B = relationships among endogenous variables (e.g., Trust → Intention)
Γ = effects from exogenous to endogenous variables (e.g., Blockchain → Trust)
ζ = error terms

These mathematical foundations support the model's estimation using maximum likelihood under multivariate normality assumptions.

Structural Equation Model Results

Finally, the full SEM model (Figure 6) shows the direct and indirect effect of different blockchain attribute on trust, satisfaction and loyalty. The outcomes confirm that Smart Contracts demonstrated the highest significant direct effect on trust ($\beta = 0.49, p < 0.001$), with the other two belief models being Transparency ($\beta = 0.41$) and Privacy ($\beta = 0.36$), all significant at $p < 0.01$.

Trust also had a strong impact on satisfaction ($\beta = 0.38$) and indirectly impacted loyalty via satisfaction ($\beta = 0.33, p = 0.004$), as verified by bootstrapping (5,000 resamples). It empirically demonstrates the trust based adoption theories in e-commerce, and paves the way for blockchain's role in better user experience.

The fit indices for the model were excellent ($CFI = 0.957, RMSEA = 0.043, \chi^2/df = 2.27$), indicating strong reliability and a good model fit (Byrne, 2016; Hair et al., 2019). These findings are consistent with earlier research in ASEAN contexts, which emphasizes technology-based trust in environments lacking robust institutional assurances (Lim et al., 2021; Nguyen & Pham, 2020).

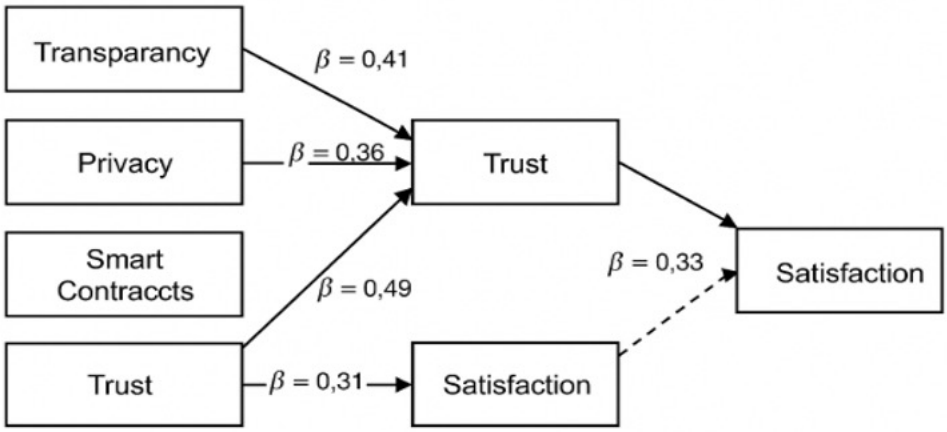

Figure 6: SEM Model – Blockchain Features → Trust → Satisfaction → Loyalty
Source: Author (2025)

Comparison Across User Segments

In order to investigate differences in a user's perception, the sample was divided into two main groups of respondents according to the respondent's familiarity with blockchain technology:

Early Adopters (n = 70): Consumers who had previous familiarity or experience with blockchain-powered applications in e-commerce.

Lay Users (n = 180): Users not familiar with the concept of blockchain.

The results showed significant differences of the trust factor scores of the two groups. This finding is particularly interesting in light of the fact that whilst early adopters had significantly more trust in blockchain-integrated platforms ($M = 4.29$) than non-technical users ($M = 3.71$), as indicated by an independent samples t-test $t(248) = 4.76, p < 0.01$. This seems to indicate that acquaintance with blockchain principles is a strong predictor of the establishment of trust — a finding corroborated by previous studies in technology adoption.

Education-level sub-segmentation revealed that the effect of smart contracts on trust was particularly

significant among participants holding a university degree, with a standardized path coefficient of $\beta = 0.61$ ($p < 0.001$). Educated users were more likely to recognize the value of automated, enforceable contracts in minimizing transactional risk—aligning with cognitive trust theory as applied in online environments (Lee & Turban, 2001).

In contrast, non-technical users demonstrated a preference for visual and interface-level trust indicators, such as blockchain verification badges, product traceability icons, and simplified trust cues. This behavior is consistent with interface-based trust models, which suggest that graphical feedback can serve as a substitute for technical understanding in fostering trust (Chandra et al., 2017).

These results may indicate that blockchain based trust mechanisms may need to be designed based on the level of literacy of the user. For the technically inclined, technical depth and transparency may be enough. But for beginners, a lack of complexity, intuitive graphics and easy-to-understand messaging around blockchain benefits is key. Accordingly, Indonesian e-commerce should utilise a two-fold strategy that integrates backing trust technologies with enabling easy-to-understand user interfaces to enhance trust in each cluster of consumers.

Discussion

Key Findings and Interpretation

The findings indicate that transparency and smart contracts are the most influential blockchain features impacting consumer trust in Indonesian e-commerce. The large standardized coefficients in the structural model suggest that users place significant value on mechanisms that enable transparent, traceable, and enforceable transactions.

From a cultural perspective, the results highlight that visibly identifiable service providers are particularly important to Indonesian consumers. Given the region's high incidence of fraud and delivery failures, blockchain's ability to provide immutable records and self-executing contracts presents a promising long-term solution to trust-related challenges (Pavlou, 2003; Lim et al., 2021).

The dominance of graphical trust signals—such as certification badges and verified product histories—further suggests that user-facing transparency, rather than secure backend processes alone, remains a preferred mechanism for establishing trust.

These findings align with previous research in developing digital markets, where confidence in technology often compensates for weaker institutional trust (Lee & Turban, 2001; Chandra et al., 2017).

Theoretical Contributions

This research offers a theoretical contribution by extending trust theory in digital commerce through the adoption of blockchain-supported mechanisms. Traditional trust dimensions—such as reliability and credibility—are reinforced by new aspects including smart contracts and ledger permanence.

Moreover, the integration of blockchain elements into existing models like the Technology Acceptance Model (TAM) and the Theory of Planned Behavior (TPB) represents a localized application of international frameworks. This adaptation helps bridge the gap created by cultural and infrastructural differences in Indonesia, a context characterized by low institutional trust and consumer decision-making that is increasingly shaped by perceived control and visually assuring indicators (Rahman & Taufik, 2021).

In this regard, the empirical confirmation of a mediating path—linking blockchain features, trust, satisfaction, and loyalty—provides new evidence on the mechanisms through which technological perceptions translate into behavioral responses.

Practical Implications for Indonesian Platforms

For market leaders and early adopters expedience as in Indonesian e-commerce (Shopee, Tokopedia), this study's results suggest a strategic dimension to integrate blockchain technology into back-end processes as well as user interface elements. The same can in turn help alleviate consumer trust concerns, especially with respect to the transparency of transactions, authenticity of the product and dispute resolution.

Specifically, platforms can implement the following enhancements:

Smart Contracts for Automated Dispute Handling:

Platforms can utilize smart contracts to reduce the possibility of common transactional risks like goods delivered late, damaged items or eligibility for returns. Such contracts can automatically enforce known rules (e.g. auto-refund after X periods without delivery), removing the reliance on manual dispute escalation. This ensures that users do not need to wait on bureaucratic processes while also increasing operational efficiency.

Blockchain-Based Product Authenticity Verification:

For those product categories which suffer a lot of counterfeiting (like electronics, branded fashion, supplements, cosmetics, etc) you can take an authenticity certificate in blockchain issued by the platforms and sign this information before to make some investment. A secure unique, digitized code is assigned to every good, and this brings about the tamper-proof information that can be searched through a QR code. This responds to the issues of increasing consumer wariness for high-value purchases and increasing post-purchase satisfaction.

User-Visible Trust Indicators:

Aesthetic trust cues are important in particular to non-technical people as is evident from the user segmentation findings in the study. These can include:

Block The "Blockchain Secured" badges next to product listings or payment steps

On-line transaction history panels, displayable verifiable delivery points

Smart contract-verified seller behaviour with the provision of seller certification seals, accredited by a smart contract

Such capabilities are more than technical improvements—they're psychological trust signals, built to make users feel safe while they travel along the customer journey.

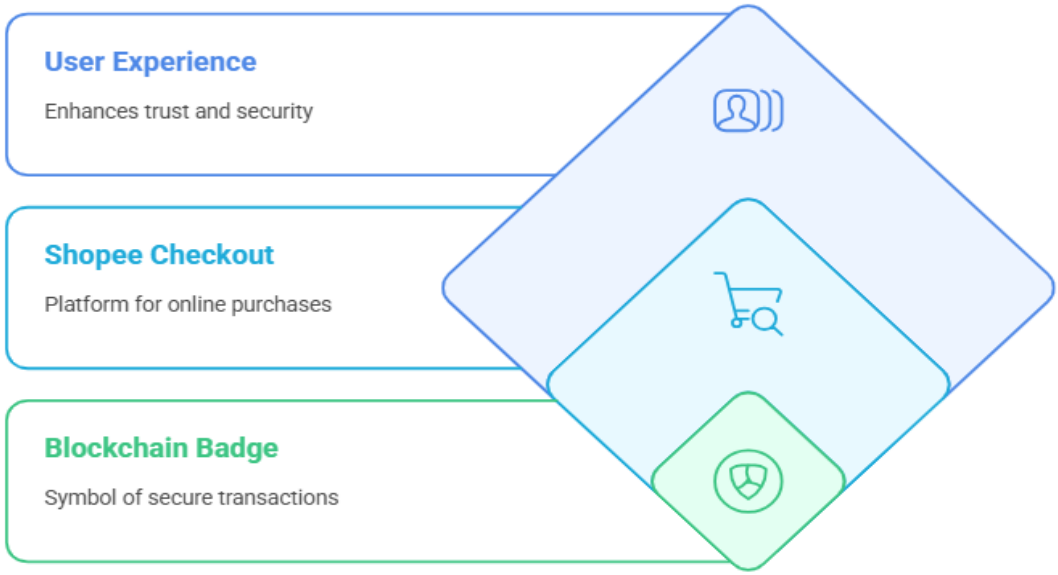

Figure 7: Mockup Blockchain Badge in Shopee Checkout Interface

Source: Author's Mockup (2025)

Such functionalities would not only fulfill user expectations, but could also be used as a differentiator in a competitive market, where users retention and loyalty is increasingly connected with the trust established with the services used.

Policy and Regulatory Implications

From a regulatory and governance standpoint, the results of this study suggest the imperative for a policy infrastructure that enables and guides the integration of blockchain into Indonesia's digital commerce environment. Regulators – like Otoritas Jasa Keuangan (OJK) and Bank Indonesia (BI) – need to play a proactive role in fostering innovation on the one hand and ensuring the safety of consumers.

The first stage would be to set up a regulatory sandbox for blockchain, similar to that implemented in the UK, Singapore and Malaysia. Deciding in favor of such a sandbox would enable startups, e-commerce platforms and FinTech players to trial blockchain-based solutions – like smart contract escrow systems and decentralized identity tools – in controlled, monitored settings. This incentivizes innovation within regulatory constraints enabling platforms to experiment with blockchain applications without risking consumer data, privacy, or financial security [55].

Furthermore, regulation should not only cover risk control but also promote capacity building. This will include advocating (e.g., interoperability protocols, audit frameworks) for the standardization of blockchain apps in digital commerce and establishing a minimum level of compliance for platforms utilizing decentralized technologies alike.

Education and public awareness are equally important. Government departments need to work with universities, online learning platforms and industry bodies to create specific training courses for 'successor' skills such as blockchain literacy. These programs must address both:

Users' education: Explaining to people that blockchain may help protect their rights in online

transactions.

Developer training: Building local software developers and platform architects capabilities to develop e-commerce systems integrated with the blockchain.

These initiatives are especially important in rural and low-literacy areas, because in their case, suspicion of online platforms is frequently compounded by low digital skill levels. Inclusive access to knowledge will in turn help more equitable adoption of secure technologies.

These policy measures will benefit from a new phase of innovation and will enable Indonesia to achieve some of the priorities of their 2025 Digital Roadmap, which is to create a secure, trusted, transparent and fair e-commerce ecosystem of tomorrow. A well-calibrated approach toward regulation – promoting experimentation while protecting the public – can enable Indonesia to be at the forefront in the region for blockchain-enabled commerce.

Limitations and Future Research

Implications. Although this paper makes a significant contribution to the literature on blockchain as a means of enhancing consumer trust in Indonesian e-commerce, several limitations should be considered when interpreting the findings.

First, the data collection was geographically limited, as responses were gathered only from two islands—Java and Sumatra. This sample may not fully capture the diversity of digital literacy, infrastructure access, or consumer behavior present in other regions such as Kalimantan, Sulawesi, or Papua. Given Indonesia's archipelagic structure and regional heterogeneity, similar variation could significantly affect trust dynamics and technology readiness (Yusuf & Idris, 2022).

Second, the research design was cross-sectional, measuring consumer attitudes at a single point in time. Since trust is a dynamic construct that evolves through repeated interactions, technological exposure, and changing market conditions, the current design cannot assess how trust in blockchain-integrated platforms may change over time (Chen et al., 2021).

Third, the study employed a predominantly quantitative approach using structured survey items. While this supports statistical validity, it may not capture the nuanced perceptions, emotional responses, and contextual cues that influence trust-related decision-making. As such, little is known about why users choose to trust or distrust blockchain functionalities beyond surface-level metrics.

Given these gaps, multiple potential avenues for future research are suggested:

Cross-national replication: Researchers are encouraged to replicate this model in other Southeast Asian economies (e.g., Vietnam, Thailand, Philippines) to test the cultural generalizability of the trust determinants in the blockchain domain. Comparative research may also reveal culture-specific expectations of technology, regulation and consumer protection.

Panel or multi-phase survey design: researchers might want to track the evolution of trust during multiple (repeated) exposures to blockchain-enabled commerce – for that panel studies or multi-phase-surveys would be necessary. These designs can provide insights into how initial skepticism may change to acceptance, and how effects of interface familiarity and reputation moderate those changes.

Qualitative research such as in-depth interviews, focus groups, or ethnography can add insights towards the meaning of trust cues, user interfaces, and risk perception among different consumer segments (e.g., elderly

users, rural buyers, low-income users). This is of immense importance for shaping the userdriven design strategies in the context of the blockchain.

Further research may facilitate a more exhaustive and elaborate theory of trust adoption in blockchain addressing these voids, thereby responding to regional peculiarities and field practice in electronic commerce as well.

Conclusion

Summary of Purpose and Main Results

The purpose of this research was to examine the impact of blockchain technology on consumer trust among Indonesian e-commerce. In an environment where electronic transactions are generally filled with distrust, fraud, and vague delivery mechanisms, blockchain technology represents an entirely new type of electronic trade: decentralized, secure, and trust-worthy. Through the use of a mixed-methods research design (literature review and quantitative structural modeling), This study provides strong empirical evidence that the smart contracts, the data privacy controls, the transaction transparency contribute to the user trust increase.

Of the concepts measured, smart contracts proved to be the most significant trust-driver ($\beta = 0.49$), followed closely by transparency and privacy. Trust also mediated the relationship between blockchain characteristics and satisfaction together with purchase intention, thereby supporting the downstream impact of technology upon consumer behavior. The segment analysis illustrates that the user´s literacy and level of technical expertise affected the interpretation of the different features of the blockchain, while early adopters provided stronger trust signals compared to non-technical users.

Research Contributions

Theoretically, this study makes several meaningful contributions:

It adds to trust literature in the context of digital commerce by incorporating unique attributes of blockchain into commonly used trust models in developing consumer trust (e.g., Technology Acceptance Model, Theory of Planned Behavior).

It provides contextual understanding of how blockchain is an increasing-trend enhancing tool for trust in economies in development, where there is not so strong institutional coverage and consumer skepticism is high.

It adds to the body of ASEAN-directed research, to which academic discourse on blockchain adoption is still relatively sparse. Unlike Western-slanted research, this study describes cultural subtleties, digital maturity disparities, and interface likes of Indonesian users, thus addressing an Eastern void on knowledge.

Moreover, the empirically supported SEM framework provides a platform for further model development which seeks to link the blockchain technology to behavioural intentions per se (such as loyalty, satisfaction, and advocacy) in low-trust digital environments.

Policy and Practical Recommendations

Based on these results, clear and actionable suggestions emerge for e-commerce platform operators and Indonesian policymakers:

Education Initiatives: One of the pressing requirements is to spread the awareness around blockchain

technology throughout Indonesia. 1 Public-private partnership between universities, regulators (e.g., OJK, BI) and tech companies should provide training programs that are built specifically for users and developers so that technology adoption can be inclusive.

Regulatory Sandboxes: Create safe spaces in which platforms can experiment with 'blockchain-y' applications (like smart contract-based refunds or decentralized identity systems) without regulatory hurdles. This would create a safe space for experimenting, while upholding consumer rights.

Platform-Level Trust Design: E-commerce platforms such as Shopee and Tokopedia should invest in trust-focus interface design that explicitly comm unicate guarantee are backed by bloc kchains. Now you can expect real- time order sh adowing, Blockchain Secured colophons in addition to an automated escrow system and a comprehensive dealer history verification

By building the blockchain at a technical and perception level, platforms can create the trust that is lacking in the Indonesian online market and support a more secure, inclusive and resilient digital economy.

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