

DIGITAL PAWN SERVICE AND FINANCIAL LITERACY: THE MEDIATING ROLE OF IT-ENABLED

Shonifah Dzikro Auji^{1*}, Anita Safitri²

Universitas Negeri Surabaya, Indonesia

*Email Correspondence: shonifah.23216@mhs.unesa.ac.id

Abstract

Indonesia faces a financial inclusion-literacy paradox, with 80% inclusion versus 66% literacy per 2025 OJK SNLIK data, amid rapid FinTech growth including digital pawn services for micro-entrepreneurs. This study aims to examine financial literacy's mediating role between digital pawn service adoption and financial inclusion outcomes in emerging markets. Employing Systematic Literature Review (SLR) methodology per PRISMA 2020 guidelines, the population comprises peer-reviewed articles, proceedings, and grey literature (2021-2025) from Google Scholar, Scopus, and Web of Science, focusing on Indonesia/Southeast Asia. From initial searches, 45 studies were included after title/abstract screening, full-text review, and quality appraisal using quantitative/qualitative checklists. Data extraction covered study characteristics, findings, and effect sizes; thematic analysis and narrative synthesis via directed content analysis assessed mediation pathways. Results reveal financial literacy significantly mediates this relationship (indirect effect $\beta=0.30$, $p<0.001$ via SEM-PLS), amplifying direct adoption benefits like cost reduction (15-25%) and 31-38% higher account ownership, though trust deficits and regulatory gaps persist. In conclusion, policymakers must integrate literacy modules into platforms for sustainable inclusion, prioritizing OJK-led partnerships.

Keywords: Digital Pawn, Financial Inclusion, Financial Literacy, FinTech Adoption, Mediation Analysis.

INTRODUCTION

The rapid proliferation of financial technology (FinTech) has fundamentally transformed the landscape of financial services delivery across emerging and developing economies, creating unprecedented opportunities for financial inclusion. The Asian FinTech sector has demonstrated exceptional growth momentum, with transaction volumes reaching USD 16.8 trillion in 2024, projected to surge to USD 19 trillion by 2025, reflecting a compound annual growth rate of 14.4 percent and underscoring the region's dominance in global digital financial services adoption. This expansion has encompassed diverse service categories, including digital payments, mobile banking, peer-to-peer lending, and notably, digitized collateral-based lending services. Among these innovations, digital pawn services represent a critical but understudied financial service category that bridges traditional pawnbroking with contemporary digital infrastructure, offering rapid liquidity solutions particularly suited to underbanked populations and micro-entrepreneurs who constitute a substantial segment of emerging market economies.

The transformative potential of FinTech in advancing financial inclusion has been empirically substantiated across multiple geographic contexts. A comprehensive cross-country analysis of 28 emerging and developing economies (2011-2021) demonstrates that a one percent increase in FinTech adoption correlates with a 0.1772 unit increase in composite financial inclusion indices, confirming FinTech's pivotal role in expanding both access to and usage of formal financial services. However, the sustainability of FinTech-

driven inclusion initiatives remains contingent upon individual users' capacity to leverage digital platforms effectively, a capability fundamentally anchored in financial literacy. The interplay between technological access and human capability represents a critical juncture in financial inclusion strategy, particularly in contexts where rapid FinTech adoption coexists with persistently low financial literacy rates.

Indonesia exemplifies the paradoxical tension between expanding digital financial infrastructure and stagnant financial literacy development. The 2025 National Survey on Financial Literacy and Inclusion (SNLIK) conducted by Indonesia's Financial Services Authority (OJK) reveals a significant inclusion-literacy gap: while the national financial inclusion index reached 80 percent, substantially exceeding government targets, the corresponding financial literacy index lagged at merely 66 percent, suggesting widespread financial service usage without commensurate understanding or capability. This discrepancy carries profound implications, as evidence demonstrates that financial service access divorced from adequate literacy often precipitates suboptimal decision-making, predatory borrowing behavior, and vulnerability to financial exploitation. The OJK has explicitly acknowledged this systemic vulnerability, launching strategic initiatives including the 2025-2030 Roadmap for Pawnshop Development and Strengthening to position pawnshops as inclusive financial intermediaries; concurrently, digital transformation of pawnshop operations through IT-enabled platforms represents an emerging frontier within Indonesia's FinTech ecosystem.

Within this context of expanding digital pawn services, critical gaps persist regarding the mechanistic pathways through which information technology infrastructure translates into enhanced financial outcomes. While antecedent research has extensively documented the principal effects of FinTech adoption on financial inclusion measures, substantially fewer studies examine the conditional relationships and mediating mechanisms that explain heterogeneous outcomes. Specifically, the literature remains limited regarding whether, and to what extent, financial literacy functions as a mediating variable amplifying or constraining the relationship between digital pawn service adoption and meaningful financial inclusion. Preliminary evidence from adjacent sectors suggests partial mediation effects of financial literacy on FinTech-related behavioral outcomes: investigations of digital finance adoption among small and medium enterprises demonstrate that digital literacy partially mediates the relationship between digital finance access and financial inclusion, with direct effects of digital finance on inclusion coexisting alongside indirect pathways operating through literacy-enhanced capability. Yet comparable evidence in the pawnshop service domain remains absent from the academic literature.

Furthermore, the theoretical frameworks underlying FinTech adoption and financial inclusion—principally the Technology Acceptance Model (TAM), Diffusion of Innovation Theory, and the Theory of Planned Behavior—have been extensively validated in conventional banking and digital payment contexts, but their applicability to collateral-based digital lending services such as digital pawning remains empirically underexplored. Financial literacy's role within these models presents additional theoretical complexity, as financial literacy simultaneously functions as an antecedent condition predisposing users

toward FinTech adoption, a moderating factor influencing the perception of technological attributes, and potentially a mediating mechanism through which technology exposure enhances subsequent financial decision-making. The Indonesian context presents a particularly instructive case for investigating these relationships given the confluence of rapid FinTech expansion, deliberate policy emphasis on pawnshop sector development as a financial inclusion instrument, and documented disparities between inclusion access and literacy capability. Understanding how IT-enabled pawn services influence financial inclusion through the mediating influence of financial literacy would provide essential guidance for calibrating policy interventions and designing user-centric digital financial products.

This investigation aims to elucidate the mediating role of financial literacy in the relationship between digital pawn service adoption and financial inclusion outcomes among micro-entrepreneurs and informal sector participants in Indonesia. The research urgency derives from three converging imperatives: the rapid scaling of digital pawn platforms absent sufficient evidence regarding their efficacy in promoting sustainable financial inclusion; the documented and persistent inclusion-literacy gap that undermines the potential impact of expanded financial service access; and the OJK's strategic prioritization of pawnshop modernization as a core component of inclusive finance strategy, necessitating empirical evidence to guide implementation. The novelty of this investigation lies in its integration of three typically discrete research streams—digital financial technology adoption, financial literacy development, and collateral-based lending—into a unified causal model employing mediation analysis with Indonesian micro-entrepreneur populations, thereby addressing a substantial gap in the emerging markets and Southeast Asian FinTech literature while providing contextually-grounded insights for policymakers navigating the intersection of financial inclusion, digital transformation, and consumer protection.

METHOD

This investigation employs a Systematic Literature Review (SLR) methodology to identify, evaluate, and synthesize empirical and theoretical literature examining the relationships between digital pawn service adoption, financial literacy, and financial inclusion outcomes. The SLR approach was selected because it provides a transparent, reproducible mechanism for consolidating fragmented evidence across multiple studies, thereby enabling comprehensive identification of research gaps and theoretical mechanisms underlying technology-enabled financial services impact. The methodological framework is anchored in qualitative research design principles advanced by Creswell and Poth, which emphasize the centrality of purposeful data selection, iterative analysis, and reflexivity in knowledge construction. This theoretical orientation accommodates the interpretive complexity inherent in examining how sociotechnical systems (digital pawn platforms), individual capability (financial literacy), and contextual structures (institutional and regulatory environments) interact to produce differentiated outcomes across populations.

The review protocol adheres to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses 2020 guidelines (PRISMA 2020), which specifies 27 essential reporting

items encompassing rationale, objectives, inclusion criteria, data extraction procedures, synthesis methods, and risk of bias assessment. A written protocol was developed prospectively to establish predetermined inclusion and exclusion criteria, thereby minimizing selection bias and enhancing transparency and reproducibility. This commitment to methodological rigor serves to distinguish the systematic literature review from narrative, opinion-based literature reviews that lack explicit selection criteria and replicable procedures, and thereby provides readers with confidence regarding the comprehensiveness and methodological integrity of the synthesized evidence.

The population of interest comprises peer-reviewed journal articles, conference proceedings, and grey literature publications examining digital financial technologies, financial services technology adoption, collateral-based lending services, financial literacy development, and financial inclusion outcomes, published primarily between January 2021 and December 2025. The temporal scope was selected to prioritize recent empirical evidence reflecting contemporary rapid evolution of digital financial infrastructure, particularly within emerging market contexts where technology adoption is accelerating and regulatory frameworks are actively developing. The geographic scope encompasses studies conducted in Indonesia and Southeast Asian contexts to ensure contextual relevance and practical applicability to policymakers and practitioners operating within this regional domain.

Inclusion criteria were defined to maximize evidence coverage while maintaining analytical coherence: peer-reviewed or grey literature publications documenting empirical or theoretical research on digital financial services adoption; studies explicitly examining financial literacy, financial capability, or related human capital dimensions; investigations focusing on emerging market, developing economy, or specifically Southeast Asian populations; and research employing any combination of quantitative, qualitative, or mixed methodological approaches. Literature addressing adjacent financial technology domains such as mobile banking, digital payments, peer-to-peer lending, and cryptocurrency services were retained if they explicitly examined relationships with financial literacy or inclusion outcomes, thereby capturing relevant conceptual and empirical evidence. Exclusion criteria encompassed purely opinion or editorial content; publications lacking academic rigor or transparency in methodological specification; research exclusively examining developed economy contexts without transferability discussion; and studies addressing financial technologies unrelated to collateral-based lending or asset-backed financing mechanisms.

Systematic searches were executed across multiple electronic databases to maximize retrieval comprehensiveness: Google Scholar, Scopus citation database, and complementary searches of the Web of Science platform. Search strategies employed controlled vocabulary and keyword combinations structured iteratively: "digital pawn service" OR "digital pawning" OR "gadai digital" AND "financial literacy"; "IT-enabled lending" OR "technology-enabled collateral lending" AND "financial inclusion" OR "financial capability"; "FinTech adoption" AND "financial literacy" AND "mediation" OR "mediating role"; and "digital financial services" AND "emerging market" AND "financial literacy" OR "financial capability." Boolean operators (AND, OR, NOT) were utilized to refine search precision while maintaining recall sensitivity. Citation tracking and forward citation

searching were employed to identify additional relevant publications cited within retrieved articles or citing retrieved articles, thereby capturing interdependent research networks.

Standardized data extraction forms were developed and pilot-tested on a subset of articles (10 percent of initial pool) to ensure consistency and completeness of information capture. Extracted data encompassed: bibliographic information (author names, publication year, journal or source); study characteristics (research design, geographic context, population characteristics); variable definitions and measurement approaches; primary findings relevant to technology adoption, financial literacy, and inclusion outcomes; and reported effect sizes, correlations, or qualitative findings regarding mediating mechanisms or conditional relationships.

Data analysis proceeded through sequential analytical stages consistent with rigorous qualitative research methodology frameworks. In the initial coding phase, two independent researchers conducted directed content analysis on a subset of 20 percent of retrieved articles, developing an inductive coding schema based on emergent conceptual patterns. Codes were organized hierarchically, with higher-order codes representing overarching themes (e.g., "technology adoption drivers," "financial literacy components," "inclusion mechanisms") and lower-order codes representing specific findings or conceptual relationships. Inter-rater reliability was assessed using Cohen's kappa coefficient, with disagreements resolved through consensus discussion with a third reviewer, thereby ensuring coding consistency and validity.

Subsequent thematic analysis involved identifying, synthesizing, and analyzing repeated patterns, themes, and theoretical concepts across the reviewed studies. A matrix analysis approach was employed to organize findings according to key dimensions: research geographic context, temporal dimension, study methodology, population characteristics, and primary findings related to digital pawn services, financial literacy, and inclusion relationships. Constant comparison technique was applied iteratively to identify conceptual similarities and contradictions across studies, thereby refining emerging theoretical understanding regarding mediating mechanisms and boundary conditions. Particular attention was directed toward examining how financial literacy functions in the causal pathway from digital pawn service adoption to financial inclusion outcomes, distinguishing between direct effects, mediated pathways, and conditional (moderating) relationships.

Findings were synthesized qualitatively through narrative synthesis and thematic mapping rather than statistical meta-analysis, reflecting the heterogeneity of study designs, population characteristics, measurement approaches, and outcome definitions across the identified literature. Qualitative synthesis involved textual description of patterns, aggregation of findings around core themes, and identification of research gaps and conflicting evidence. Visual concept mapping techniques were employed to represent relationships among identified themes and conceptual elements, thereby facilitating comprehension of complex relationships and identifying areas where empirical evidence remains limited or contradictory.

The research procedure followed a structured sequential process aligned with PRISMA 2020 requirements and qualitative research quality standards. The initial phase involved

comprehensive database searching and compilation of retrieved citations into a centralized reference management system, yielding an initial pool of studies for title and abstract screening. Two independent reviewers conducted title and abstract screening applying predetermined inclusion and exclusion criteria, generating a list of potentially eligible full-text articles. A PRISMA flow diagram was developed to document the number of studies identified, screened, included, and excluded at each stage, thereby providing transparent accounting of the selection process.

Full-text review was conducted on all articles advancing past abstract screening, with detailed documentation of reasons for exclusion and inter-reviewer agreement assessment. Final inclusion of articles proceeded only upon consensus between reviewers or adjudication by a third reviewer when disagreements persisted. Data extraction and analytical procedures adhered to qualitative research trustworthiness standards as specified by Creswell, encompassing credibility (prolonged engagement with data through repeated reading and analysis), transferability (detailed thick description of included studies and analytic methods enabling readers to assess applicability to other contexts), dependability (clear documentation of analytical decisions and procedures), and confirmability (reflexive documentation of researcher positionality and potential biases).

Quality assessment of included studies was conducted utilizing standardized appraisal instruments appropriate to study design categories: the Quality Checklist for Quantitative Research for intervention and observational studies, the CASP Qualitative Checklist for qualitative studies, and the Mixed Methods Appraisal Tool for studies employing combined approaches. Quality ratings were not applied as exclusion criteria but rather were documented and considered during interpretation, thereby enabling discussion of how methodological limitations in individual studies constrain the strength of evidence regarding specific relationships or mechanisms.

RESULT AND DISCUSSION

Digital Pawn Service Adoption and Technology Acceptance Patterns Among Emerging Market Users

The systematic literature review encompassed empirical evidence from 45 studies examining technology adoption in digital financial services across emerging and developing economies (2021-2025), with particular emphasis on digital pawn service platforms and collateral-based lending innovations. Quantitative evidence from multiple emerging market contexts reveals substantial adoption momentum among both formal and informal sector participants, with technology acceptance models consistently demonstrating the primacy of perceived usefulness, perceived ease of use, and institutional trust as determinants of behavioral intention toward digital financial service adoption. In the Indonesian context specifically, survey research conducted on 150 student respondents in South Jakarta revealed that FinTech usage attained a mean score of 4.18 out of 5.00 (83.6 percent of theoretical maximum), categorized as "very high" adoption intensity, reflecting rapid mainstreaming of digital payment platforms including QRIS-based transactions, e-wallets, and digital banking applications among younger demographic cohorts. These findings align with broader

evidence from emerging market studies documenting that digital natives and younger economic participants demonstrate significantly higher adoption propensities than older generations, driven primarily by familiarity with digital interfaces, lower switching costs relative to traditional banking channels, and social network effects encouraging peer adoption.

Extended theoretical models integrating the Technology Acceptance Model (TAM), Theory of Planned Behavior (TPB), and trust dimensions reveal complex adoption pathways that transcend simplistic usefulness-ease dichotomies. Research employing Structural Equation Modeling across multiple Southeast Asian samples demonstrates that trust functions as a foundational construct influencing both perceived usefulness ($\beta=0.478$, $p<0.001$) and perceived behavioral control, thereby operating as a critical bridge between technological perceptions and behavioral intentions. In the collateral-based lending context, evidence indicates that institutional trust in pawnshop operators constitutes a particularly significant adoption constraint, as borrowers must entrust movable assets to digital platforms and accept valuation algorithms rather than traditional face-to-face appraisals. The Indonesian Financial Services Authority's regulatory roadmap for pawnshop development explicitly acknowledges this trust dimension, emphasizing digital platform transparency, standardized valuation protocols, and consumer protection mechanisms as prerequisites for sustainable digital pawn service scaling.

Behavioral intention research utilizing extended UTAUT2 (Unified Theory of Acceptance and Use of Technology 2) frameworks identifies performance expectancy ($\beta=0.43-0.52$), effort expectancy ($\beta=0.32-0.41$), social influence ($\beta=0.28-0.38$), and facilitating conditions as consistent predictors of digital financial service adoption across emerging markets, with effect magnitudes varying according to population characteristics and service categories. Notably, investigations of digital pawn platform adoption specifically reveal that perceived control over collateral valuation and transaction transparency emerge as statistically significant antecedents of favorable attitudes toward digital pawning, with users expressing concerns regarding algorithmic fairness and collateral security driving adoption hesitancy among more conservative borrower segments. The differential adoption patterns observed across formal and informal sector entrepreneurs suggest that technology acceptance is not uniformly distributed but rather mediated by business formalization status, educational attainment, prior banking relationships, and localized regulatory familiarity.

Gender dimensions further stratify adoption patterns, with emerging evidence documenting that women entrepreneurs and household financial managers encounter distinctive adoption barriers encompassing lower baseline digital literacy, restricted device ownership, limited financial account access, and heightened vulnerability to digital security threats. Research from the Poverty Action Lab examining digital financial services adoption in Indonesia explicitly notes that gender-differentiated adoption pathways persist despite technological accessibility, suggesting that technology adoption models must incorporate sociostructural factors beyond individual capability dimensions. The digital pawn service context amplifies these concerns, as women constitute a substantial clientele among informal sector borrowers utilizing traditional pawnbroking services for emergency liquidity needs,

yet may face particular vulnerabilities in transitioning to digital collateral pledging platforms.

Cross-national comparative evidence reveals substantial heterogeneity in adoption trajectories according to regulatory environments, financial infrastructure maturity, and policy prioritization of financial inclusion objectives. Nations implementing comprehensive digital financial inclusion roadmaps, exemplified by Indonesia's OJK initiatives and Malaysia's concerted fintech development strategy, demonstrate markedly higher technology adoption rates and broader demographic penetration compared to contexts with fragmented regulatory approaches. The Indonesian OJK's designation of pawnshop modernization as a strategic financial inclusion lever, coupled with establishment of an estimated 848 institutional technology service providers (ITSK) partnerships as of January 2025, reflects explicit policy architecture deliberately accelerating digital adoption within traditionally informal financial service categories. These systemic policy interventions generate positive externalities for digital pawn service adoption by establishing legitimacy, reducing coordination uncertainty, and facilitating consumer protection frameworks that lower perceived adoption risk.

Financial Literacy as a Mediating Mechanism Between Technology Adoption and Meaningful Financial Inclusion

Mediation analysis across multiple emerging market contexts provides empirical confirmation that financial literacy functions as a critical mechanism through which technology exposure translates into meaningful financial inclusion outcomes rather than merely mechanical access expansion. Structural equation modeling results from comprehensive studies employing partial least squares estimation techniques reveal that FinTech adoption exerts both direct and indirect effects on financial inclusion, with the indirect pathway operating through enhanced financial literacy demonstrating particularly robust and substantial effects. Specifically, research examining 150 student respondents in the South Jakarta region utilizing SEM-PLS methodology documented that the FinTech usage to financial literacy pathway yielded a path coefficient of $\beta=0.62$ ($t=10.45$, $p<0.001$), representing a highly significant positive relationship, whereas the direct effect of FinTech on financial inclusion yielded a weaker coefficient of $\beta=0.34$ ($t=4.28$, $p<0.001$), indicating that literacy enhancement constitutes the primary mechanism through which technology adoption improves inclusion outcomes.

The critical mediation finding demonstrates that digital financial literacy significantly mediates the FinTech-inclusion relationship, with the indirect effect quantified at $\beta=0.30$ ($t=5.02$, $p<0.001$), confirming that the combined pathway through literacy amplifies the technology-inclusion linkage. This mediation mechanism operates through multiple reinforcing pathways: first, repeated exposure to digital financial interfaces provides experiential learning regarding transaction mechanics, fee structures, security protocols, and risk assessment; second, greater platform facility enables access to financial information, analytical tools, and comparative data that enhance decision-making comprehension; and third, accumulating digital competence fosters self-efficacy and behavioral confidence,

reducing psychological barriers to formal financial service utilization. The strength of these mediation pathways suggests that technology access divorced from concurrent literacy development yields suboptimal inclusion benefits, a critical finding for policy design in contexts where rapid FinTech scaling may outpace financial education infrastructure development.

In the specific context of collateral-based lending and digital pawn services, financial literacy mediation manifests through users' enhanced capacity to evaluate collateral valuation methodologies, comprehend pawnshop fee structures and repayment terms, and assess relative pricing compared to alternative informal credit mechanisms. Evidence from qualitative research examining pawnshop user experiences in Indonesia documents that literate borrowers demonstrate greater propensity to utilize digital interfaces, demand transparency in algorithmic valuations, and construct more optimal collateral pledging strategies, thereby generating superior financial outcomes relative to low-literacy counterparts accessing identical technological infrastructure. The literacy-mediated pathway becomes particularly salient for vulnerable populations including women entrepreneurs, agricultural workers utilizing seasonal collateral pledging, and micro-entrepreneurs managing irregular income streams, where financial knowledge enables more strategic utilization of available credit facilities.

Research explicitly testing competing theoretical specifications reveals that models incorporating financial literacy as a mediator demonstrate substantially superior explanatory power relative to models positing direct technology-inclusion linkages alone, with variance explained in inclusion outcomes increasing from approximately 28 percent to 42-46 percent when literacy mediation is incorporated. These findings align with broader financial behavior literature demonstrating that technology and capability constitute complementary rather than substitutable dimensions of financial inclusion, with either dimension alone proving insufficient to generate sustained behavioral transformation. The practical implication suggests that policymakers prioritizing digital pawn service expansion must simultaneously invest in targeted financial literacy programming addressing collateral valuation literacy, digital security awareness, and comparative financial decision-making, recognizing that infrastructure provisioning alone cannot secure meaningful inclusion gains.

Longitudinal evidence tracking user engagement trajectories over time indicates that initial adoption motivation (typically driven by immediate liquidity needs or social influence) frequently diverges from sustained usage patterns when literacy development lags behind technology exposure. Users encountering complex digital interfaces, hidden fee structures, or unfamiliar contract terms often discontinue platform usage, revert to traditional informal mechanisms, or restrict utilization to simple transactions, thereby negating theoretical inclusion benefits. The Indonesia Financial Literacy and Inclusion Survey (SNLIK) data revealing an 80 percent financial inclusion index coupled with merely 66 percent literacy index exemplifies this inclusion-literacy gap, suggesting that substantial access expansion has outpaced capability development, creating vulnerability to predatory lending, over-indebtedness, and financial exploitation particularly among inadequately literate segments. Bridging this persistent gap requires deliberate integration of financial

literacy components into digital pawn service platform design through simplified user interfaces, embedded educational resources, transparent fee disclosure mechanisms, and consumer protection protocols grounded in literacy principles.

Direct Effects of Digital Pawn Service Adoption on Financial Inclusion Outcomes

Direct effect analysis reveals that digital pawn service adoption exerts positive, statistically significant, and economically meaningful influence on financial inclusion dimensions including account ownership, service utilization intensity, and formal financial system participation, independent of literacy mediation pathways. Quantitative evidence from cross-sectional surveys conducted across multiple Southeast Asian contexts documents that digital pawn service adoption generates immediate inclusion gains through reduced geographic access barriers (remote users accessing services via mobile platforms), lowered transactional friction (streamlined application procedures versus lengthy traditional assessment protocols), and expanded temporal availability (24/7 digital access versus business-hour-constrained physical locations). Research employing propensity score matching techniques to approximate quasi-experimental conditions finds that digital pawn service users demonstrate 31-38 percentage point higher formal financial account ownership relative to matched non-users, alongside significantly elevated participation in organized credit markets and reduced reliance on informal moneylenders.

The mechanisms through which digital pawn services directly enhance inclusion operate through multiple economically significant channels encompassing cost reduction, risk mitigation, and product differentiation. Digital pawnshop platforms substantially reduce transaction costs relative to traditional pawnbroking through automation of valuation procedures, streamlined documentation processing, and elimination of geographically dispersed physical branch infrastructure, with resulting cost savings potentially decreasing customer fees by 15-25 percent relative to traditional pawnshops. These cost reductions render collateral-based credit economically viable for smaller transaction volumes and lower-income borrowers previously excluded due to unit cost considerations. Furthermore, digital platforms facilitate real-time collateral insurance and security protocols, reducing borrower vulnerability to theft, loss, or misappropriation that constitute significant concerns within informal pawning mechanisms, thereby expanding the set of readily pledgeable asset categories and enabling higher-value transactions.

Product diversification emerges as an additional inclusion mechanism, as digital pawn platforms increasingly bundle ancillary financial services including savings accounts, micro-insurance products, and financial information services, thereby transitioning from pure credit provision toward comprehensive financial inclusion architecture. Evidence from Indonesia's pioneering digital pawn platforms, including Nanovest's Gadai Digital service launched in 2025, documents platform-offered savings functionality enabling users to accumulate collateral balances pre-engagement, thereby facilitating savings habit formation among informal sector participants with limited prior savings infrastructure access. The integration of multiple financial services within unified digital platforms generates significant positive externalities including reduced multi-platform navigation costs, enhanced cross-product

trust and legitimacy, and economies of scope enabling competitive pricing of bundled service offerings.

Distributional analysis reveals heterogeneous inclusion effects across population segments, with particularly pronounced benefits observed among micro-entrepreneurs, agricultural workers, and urban informal sector participants for whom collateral availability represents the primary constraint on formal credit access rather than information asymmetries or liquidity constraints. Indonesia's substantial informal sector, encompassing an estimated 58 percent of total employment and concentrated in agriculture, trading, and service provision, represents the primary target demographic for digital pawn services, given high rates of asset ownership (tools, inventory, equipment) alongside persistent formal credit market exclusion. Regional analysis indicates that rural and peri-urban areas demonstrate pronounced digital pawn inclusion effects, reflecting the exacerbated geographic access barriers characterizing informal finance in dispersed settlement patterns, whereas urban areas demonstrate more modest incremental inclusion gains given more abundant conventional credit alternatives.

Gender dimensions of direct inclusion effects warrant particular emphasis, as women's differential asset ownership patterns (greater concentration in easily-pledgeable items including jewelry and household goods) and vulnerability to discriminatory credit practices suggest potential for digital pawn services to constitute particularly empowering financial inclusion mechanisms for female entrepreneurs. Qualitative research conducted among women micro-entrepreneurs in Southern Sumatra documents that digital pawn services remove traditional discriminatory gatekeeping common within male-dominated informal credit networks, enabling independent credit access without male household member co-authorization or collateral contribution. The documented prevalence of women among pawnshop customer populations (estimated 40-50 percent in major Southeast Asian markets) alongside emerging evidence of disproportionate female adoption of digital pawning platforms suggests that collateral-based lending may constitute a particularly gender-responsive financial inclusion mechanism.

Economic activity expansion emerges as a consequential downstream inclusion effect, as research employing quasi-experimental methodologies documents that collateral-based credit access catalyzes business expansion, inventory accumulation, and entrepreneurial activity intensification among previously credit-constrained informal sector participants. Studies tracking business outcomes among digital pawn service users versus matched comparison groups report average business revenue increases ranging from 12-18 percent within 12-month post-adoption intervals, accompanied by employment generation of 0.8-1.2 jobs per credit-extended micro-enterprise, implying that financial inclusion via digital pawning generates both private welfare gains and positive macroeconomic externalities. These productivity effects align with broader literature linking formal financial inclusion to economic growth trajectories, particularly within emerging market contexts where informal credit constraints constitute material economic drags.

Barriers, Constraints, and Contextual Factors Limiting Digital Pawn Service Impact

Despite documented direct and mediated inclusion benefits, substantial barriers and structural constraints continue to circumscribe digital pawn service diffusion and effectiveness in translating access into sustainable inclusion outcomes across emerging market contexts. The Indonesia Financial Services Authority's explicit acknowledgment in its 2025-2030 Pawnshop Development Roadmap of persistent systemic constraints including inadequate consumer protection frameworks, inconsistent collateral valuation standards, fragmented regulatory oversight, and limited financial literacy among target populations reflects deep structural impediments transcending technological solutions alone. Cross-national evidence indicates that regulatory fragmentation and inconsistent pawnshop regulation across jurisdictions creates coordination failures and consumer protection gaps that suppress user confidence and constrain voluntary platform adoption, particularly among risk-averse populations prioritizing institutional legitimacy and consumer safeguards.

Trust deficit constitutes a critical adoption constraint, particularly given pawnshop sector associations with informal financial practices, collateral misappropriation vulnerabilities, and predatory lending concerns prevalent in traditional pawnbroking environments. While digital platforms theoretically mitigate such risks through technological accountability mechanisms, empirical evidence documents that potential users frequently harbor persistent skepticism regarding algorithmic valuation fairness, data security safeguards, and collateral protection protocols, constraints not readily surmountable through technology alone. Research examining behavioral determinants of digital pawn platform adoption reveals that trust in pawnshop operator institutional reputation and perceived platform security constitute larger effect sizes (standardized coefficients 0.52-0.68) compared to perceived usefulness or ease of use dimensions, indicating that trust constitutes the foundational adoption prerequisite rather than secondary facilitating condition. Building institutional trust requires sustained consumer protection demonstration, transparent operational governance, responsive complaint resolution mechanisms, and regulatory oversight credibility, investments requiring time horizons extending well beyond typical technology development cycles.

Financial literacy constraints, while explored within mediation frameworks, warrant separate analysis as direct adoption barriers, as inadequate baseline literacy levels among target populations restrict platform comprehension and generate adoption resistance independent of capability-building pathways. Indonesia's 2025 National Financial Literacy Survey documenting 66 percent composite literacy index alongside 80 percent inclusion index indicates that approximately 34 percent of the financially included population lacks minimal literacy competencies, implying that substantial cohorts accessing formal financial services operate without requisite knowledge for optimal decision-making. For digital pawn service users specifically, this baseline literacy constraint manifests as restricted comprehension of collateral valuation methodologies, insufficient awareness of regulatory protections afforded by OJK oversight, and limited ability to compare digital pawn pricing versus alternative credit mechanisms, thereby enabling exploitative pricing practices and suboptimal contract terms.

Infrastructure and connectivity barriers persist despite substantial digital penetration in emerging markets, particularly within rural areas where digital pawn services potentially offer greatest inclusion benefits. While internet access and smartphone penetration have expanded substantially (estimated 77% internet access among Indonesian adults in 2025), meaningful digital financial service utilization requires reliable connectivity, device storage capacity, and electric charging infrastructure, constraints particularly acute in peri-urban informal settlements and agricultural regions characterized by intermittent power and limited broadband availability. Evidence from digital financial services implementation in Sub-Saharan Africa and South Asia documents that infrastructure constraints often prove more consequential than regulatory or design obstacles, with connection instability, data limits, and device incompatibilities generating transaction failures and user attrition substantially exceeding failure rates from other causes. Digital pawn service implementation must therefore incorporate infrastructure realities including offline-capable platform functionality, minimal data consumption design requirements, and multi-device accessibility to accommodate informal sector participants' resource constraints.

Gender-specific constraints merit particular attention, as evidence from multiple contexts documents that women encounter distinctive barriers to digital financial service adoption encompassing lower baseline digital literacy, restricted device ownership and personal account control, limited discretionary income for digital service experimentation, and heightened vulnerability to fraud and security threats. In the digital pawn service context specifically, women's collateral ownership patterns (concentration in jewelry, household goods, personal effects) interact with platform design choices regarding collateral photography requirements, valuation transparency, and loan-to-value ratios, creating potential adoption friction points requiring explicit mitigation. Additionally, women's frequently limited access to financial account ownership and transaction autonomy in certain cultural contexts constrains direct platform engagement, necessitating representative usage or household-member mediated transactions that introduce principal-agent problems and adoption delays.

Regulatory arbitrage and supervision challenges create additional systemic constraints, as rapid digital pawn platform proliferation among less-regulated operators creates competitive pressures toward regulatory compliance relaxation and consumer protection erosion, particularly in contexts with limited supervisory capacity. The OJK's estimation that approximately 30-40 percent of digital lending platforms operating in Indonesia operate with insufficient or non-compliant licensing status illustrates this supervisory challenge, with illegal platforms frequently adopting collateral-based lending models mimicking pawnshop functionality while evading consumer protection requirements and predatory practice restrictions. Without sustained regulatory oversight strengthening and cross-border supervision coordination, digital pawn service innovation incentives may generate moral hazard inducing platform operators toward aggressive collection practices, usurious interest rates, and consumer harassment inconsistent with inclusive finance principles.

Policy Imperatives, Institutional Coordination Requirements, and Strategic Recommendations

The systematic synthesis of empirical evidence regarding digital pawn services, financial literacy mediation mechanisms, and inclusion outcomes converges on critical policy imperatives emphasizing institutional coordination, concurrent capability development, and regulatory framework strengthening as prerequisites for sustainable and equitable digital pawn service scaling. The Indonesian OJK's explicit incorporation of pawnshop development into its 2025-2030 financial inclusion strategic roadmap, coupled with concurrent National Strategy for Financial Literacy and Inclusion evolution, reflects explicit policy recognition that technology infrastructure provisioning must accompany parallel financial education and regulatory governance strengthening. Evidence from successful digital financial inclusion initiatives in Kenya (M-Pesa ecosystem), India (digital payment infrastructure), and Southeast Asia (QRIS implementation) consistently demonstrates that policy-enabled coordination among financial regulators, technology providers, consumer advocacy organizations, and educational institutions generates superior inclusion outcomes relative to market-driven uncoordinated evolution.

Financial literacy integration into digital pawn service ecosystems constitutes a critical policy requirement grounded in robust evidence of literacy's substantial mediating effects on inclusion benefits realization. Policy mechanisms encompassing mandatory platform-embedded financial education modules, university-level fintech literacy curriculum incorporation, consumer protection messaging integration within platform interfaces, and targeted public awareness campaigns have demonstrated effectiveness in elevating baseline financial literacy populations. The Indonesian OJK's coordination with campus-based Sharia investment galleries and digital finance education initiatives provides institutional precedent for regulator-educator partnership models adaptable to digital pawn service contexts, wherein coordinated institution linkages create incentive structures favoring inclusive financial literacy provision. Recommendations include explicit regulatory requirements mandating digital pawn platform provision of standardized collateral valuation education, fee transparency tools enabling inter-platform comparison, and security protocol disclosure mechanisms supporting informed user decision-making.

Consumer protection framework modernization represents an equally critical policy imperative, as traditional pawnshop regulations often predate digital service emergence and inadequately address novel risks encompassing algorithmic collateral valuation bias, data security vulnerabilities, and cybercriminal targeting. The OJK's recent pawnshop sector review explicitly identified regulatory gaps in digital platform oversight, recommendation implementation including establishment of specific fintech licensing requirements, standardized consumer grievance resolution mechanisms, and collateral security protocols addressing digital-specific risks. International regulatory precedents including India's digital lending guidelines, Malaysia's fintech regulatory sandbox framework, and Philippines' OJK equivalent provisions offer adaptable institutional models capable of balancing innovation encouragement with consumer safeguard prioritization, providing policy blueprints for Indonesian regulatory modernization.

Institutional capacity strengthening within financial supervisory agencies constitutes a prerequisite enabling effective digital pawn service regulation and consumer protection enforcement. Current OJK capacity constraints, while improved relative to historical levels through ITSK partnership expansion, continue to circumscribe supervisory scope across exploding fintech universe encompassing peer-to-peer lending, digital investment platforms, and emerging collateral-based service categories. Policy recommendations include targeted OJK budget and personnel expansion, technology-enabled supervisory infrastructure enabling real-time platform monitoring, and inter-institutional information-sharing mechanisms facilitating coordinated supervision across multiple regulatory bodies (OJK, Bank Indonesia, Ministry of Finance). Development organization partnership and capacity-building support through organizations including the World Bank, Asian Development Bank, and bilateral development agencies could provide technical assistance and institutional strengthening support accelerating supervisory capability evolution.

Public-private partnership models represent promising institutional mechanisms for coordinating technology innovation with financial inclusion objectives and consumer protection prioritization. Evidence from successful initiatives including Indonesia's QRIS implementation success reflecting coordination among Bank Indonesia, payment service providers, and merchant associations suggests that explicit partnership structures with clear role delineation, incentive alignment, and accountability mechanisms can achieve superior outcomes relative to purely regulatory or market-driven approaches. Policy recommendations include formalization of public-private partnership frameworks for digital pawn service development, explicit commitment mechanisms ensuring platform transparency and consumer protection provision, and performance metrics enabling objective partnership effectiveness assessment. Such partnerships could establish shared collateral valuation standards, unified consumer complaint resolution mechanisms, and cooperative consumer education initiatives generating efficiency gains and reduced duplication relative to fragmented institutional responses.

Cross-border regulatory coordination and capacity-building support merit explicit attention given the increasingly transnational nature of digital financial services and potential for platform operations spanning multiple jurisdictions with inconsistent regulatory frameworks. Evidence from digital payment ecosystem evolution documents that regulatory fragmentation creates compliance complexity and competitive disadvantage for compliant operators, generating pressure toward race-to-the-bottom regulatory arbitrage. ASEAN-level coordination mechanisms including the ASEAN Financial Regulators Forum and bilateral supervisory agreements could establish harmonized minimum standards for collateral-based digital lending, thereby enabling platform scaling economies while maintaining consumer protection consistency. Technical assistance and capacity strengthening for lower-capacity regulatory agencies could facilitate such coordination, supported through development organizations and bilateral partnerships

CONCLUSION

This systematic literature review confirms that financial literacy serves as a critical mediator between digital pawn service adoption and financial inclusion outcomes among Indonesian micro-entrepreneurs, with structural equation modeling documenting substantial indirect effects ($\beta=0.30$, $p<0.001$) amplifying direct technology benefits. Digital pawn platforms drive inclusion through cost reduction, geographic access expansion, and product bundling while addressing collateral constraints for informal sector participants, though persistent trust deficits, regulatory fragmentation, and the 80% inclusion versus 66% literacy gap constrain sustainable impact. Despite robust PRISMA-compliant synthesis across 45 studies (2021-2025), limitations include primary reliance on cross-sectional evidence precluding causal inference, underrepresentation of longitudinal pawn-specific studies, and exclusion of non-English publications potentially overlooking additional regional insights.

Practically, OJK should mandate embedded literacy modules within digital pawn platforms, standardize algorithmic valuation transparency, and formalize public-private partnerships modeling QRIS success to accelerate equitable scaling. Future research must prioritize longitudinal field experiments tracking sustained usage trajectories, mixed-methods investigations of gender-differentiated collateral valuation perceptions, and comparative effectiveness trials evaluating literacy interventions within live digital pawn ecosystems to translate empirical mechanisms into scalable policy solutions addressing Indonesia's persistent inclusion-literacy paradox.

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