

Artificial Intelligence as a Catalyst for Hybrid Payment Ecosystems: Reconceptualising the Cash Paradox in Developing Economies

Rohaiza Kamis*, Nor Shahrina Mohd Rafien, Nurul Ain Mustakim, Amizatul Hawariah Awang

Faculty of Business and Management, Universiti Teknologi MARA Cawangan Melaka, 110 off Jalan Hang Tuah, 75300, Melaka, Malaysia

DOI: <https://doi.org/10.47772/IJRISS.2026.100700009>

Received: 11 July 2026; Accepted: 16 July 2026; Published: 22 July 2026

ABSTRACT

Digital payments are spreading quickly, and artificial intelligence (AI) is often described as the technology that will finally push economies to go cashless. In both developed and developing countries, people still use a great deal of cash even where digital payments are common. This study refers to this contradiction as the cash paradox and argues that it is not a temporary issue that technological advances will eventually eliminate. Instead, it represents a persistent structural characteristic of modern payment systems. Building on this view, the study develops the AI-Enabled Cash Paradox Framework, which treats the paradox as the central idea for explaining how payment systems change over time rather than as an obstacle to be eliminated. The framework draws on three well-established theories: the Technology Acceptance Model, Diffusion of Innovations theory, and institutional theory. It is built from a review of twenty studies selected through a transparent, PRISMA-guided search of Emerald Insight, Scopus, Web of Science, and Google Scholar. The study makes two main contributions. First, it defines AI Capability as a single construct with four connected parts, namely sensing, analytical, adaptive, and trust-building capability, rather than treating AI as a loose list of tools. Second, it sets out three linked propositions that connect AI Capability, the growth of digital payments, the cash paradox, and the rise of hybrid payment ecosystems. On this view, the role of AI is to manage the paradox rather than resolve it, bringing digital and physical payments together into one system that is resilient and inclusive. The framework offers an integrated way of thinking about payments and provides guidance for policymakers, regulators, banks, and fintech firms in developing economies.

Keywords: Artificial Intelligence, Cash Paradox, Digital Payments, Financial Inclusion, Hybrid Payment Ecosystem

INTRODUCTION

Over the past decade, steady advances in technology, widespread internet access, and rising smartphone ownership have changed the way consumers, businesses, and governments handle money (Daragmeh et al., 2021). Cash transactions are increasingly joined by a wide range of digital options such as mobile wallets, QR-code payments, contactless cards, real-time transfers, and digital banking apps. Around the world, policymakers and financial institutions have made the move toward a cashless society part of their digital strategies (Muthusamy et al., 2024). They are drawn by the promise of lower costs, greater efficiency, better transparency, and wider access to finance. Across Asia, countries such as China, Indonesia, Vietnam, India, and Malaysia are all moving in this direction (Purwatiningsih, 2025; Ly & Ly, 2024).

Artificial intelligence (AI) is widely seen as the technology most likely to shape what comes next. In finance, AI now supports real-time fraud detection, credit checks based on alternative data, chat-based customer service, and personalised product recommendations. These uses reduce losses, build trust, and extend services to people who have no formal banking record (Kshetri, 2021; Mhlana, 2021). Hence, AI is often presented as the final push that will make cash disappear. In reality, the cashless society has not arrived on schedule. Evidence from many countries shows that even where digital payments grow rapidly, the amount of cash in circulation stays high, and cash has proven far more durable than earlier forecasts expected (Ozili, 2023; Rahman et al., 2021).

This study defines the gap between rising digital payments and steady demand for cash as the cash paradox. Cash still does things that digital tools do not fully match. It works when systems fail, when the power goes out, or when networks are attacked. It protects privacy and provides access to people who are excluded from the digital economy. It also remains the practical choice for small and informal businesses that face limits on cost, customer preference, or infrastructure (Bech et al., 2018; Somogyvári, 2021). For these reasons, the simple story that digital payments will replace cash no longer holds, and a mix of payment methods better describes what is happening. Getting this wrong has real costs, because it can shut people with low digital skills or weak internet access out of formal financial services.

Nonetheless, existing research offers a limited basis for understanding this coexistence, and the reason is more structural than a simple shortage of studies. Work on digital payment adoption, cashless policy, financial inclusion, and AI has grown up as four largely separate conversations, each with its own concepts and outcomes. Technology acceptance models explain why individuals adopt a payment tool, but they stop at the point of adoption and say nothing about why cash endures (Davis, 1989; Daragmeh et al., 2021). Cashless society frameworks treat cash as a residual that policy should phase out, so they cannot account for its stubborn persistence (Somogyvári, 2021; Rahman et al., 2021). Financial inclusion studies show that digital channels reach the unbanked, yet they rarely connect this reach to the specific capabilities of AI (Senyo & Osabutey, 2020; Mhlanga, 2020). Studies of AI in finance, in turn, catalogue tools such as fraud detection and credit scoring without asking how those tools reshape the demand for cash (Königstorfer & Thalmann, 2020; Bello & Olufemi, 2024). As these strands rarely intersect, the field has no framework that integrates all four domains at once, and therefore no clear account of how the same capabilities that speed up digital payments also change, rather than remove, the conditions that keep cash useful. Table 1 sets the proposed framework against these earlier models and shows the specific integration that each one lacks. This gap is widest in developing economies, where the interaction between AI, digital growth, and cash use is strongest yet least studied. Collectively, these gaps demonstrate the need for a holistic framework that captures the dynamic relationships among the key constructs.

Table 1: Previous Conceptual Perspectives Compared with the Proposed Framework

Body of work	Central idea	What it explains	What it leaves out
Technology acceptance models (e.g. TAM, DOI)	Adoption depends on perceived usefulness and ease of use.	Why individuals take up a new digital payment tool.	Stops at adoption; says nothing about why cash endures alongside it.
Cashless society frameworks	Digital payment is the goal; cash is a residual to be phased out.	The policy case for reducing cash and the gains in cost and transparency.	Cannot account for the observed persistence of cash demand.
Financial inclusion studies	Digital and mobile channels extend services to the unbanked.	How reach widens in underserved and developing-economy settings.	Rarely links inclusion to the specific capabilities of AI or to cash use.
AI-in-finance studies	AI supplies tools such as fraud detection, scoring, and chat services.	How individual AI applications improve efficiency and access.	Treats AI as a list of tools; ignores its effect on the value of cash.
AI-Enabled Cash Paradox Framework (this study)	AI Capability drives digital growth, which sharpens rather than removes the cash paradox and produces a hybrid ecosystem.	Why digital payments and cash demand rise together, across all four domains at once.	The proposed framework is conceptual and requires empirical testing to validate the proposed relationships.

The central argument is therefore that AI should not be seen as a way to get rid of cash, but as a way to build payment systems that are more flexible, inclusive, and resilient. The payment system of the future is best described as a hybrid one, in which digital and physical methods support each other and operate together. In response to this gap, the study defines AI Capability as a single construct, builds the AI-Enabled Cash Paradox Framework through a transparent review of the literature, and states three theory-based propositions for future testing.

LITERATURE REVIEW

1. Artificial Intelligence Capability as a Single Construct

Earlier research on payment tends to list AI uses such as fraud detection, credit scoring, chatbots, and recommendation engines without explaining the underlying capability that ties them together. The present study takes a different approach and treats AI Capability as a single construct with four related parts. The construct is not adopted wholesale from any one source. It is synthesised from prior work by grouping the AI functions that recur in the payment and inclusion literature into four families and then naming the capability that each family expresses. Sensing capability is the ability to spot patterns, unusual activity, and risk as they happen, as machine-learning fraud detection does (Bello & Olufemi, 2024). Analytical capability turns alternative and behavioural data into decisions, which matters most for assessing credit for people without formal records (Mhlanga, 2021). Adaptive capability personalises and adjusts services to the situation through chat interfaces and recommender systems (Königstorfer & Thalmann, 2020). Trust-building capability improves how safe and reliable a service feels, which shapes user confidence in digital channels (Kshetri, 2021). These four dimensions were selected for two reasons. First, each one maps directly onto a documented driver of payment adoption, so the construct stays close to the behaviour the framework needs to explain. Second, together they span the full path a user travels, from noticing risk, to having a decision made, to receiving a tailored service, to deciding whether to trust it. Other capabilities that appear in the wider AI literature, such as explainability, autonomy, predictive capability, learning capability, and interoperability, were treated as underlying properties rather than separate dimensions. Prediction and learning operate inside sensing and analytical capability, explainability operates inside trust-building capability, and autonomy and interoperability describe how a system is engineered rather than how a user experiences it. Folding them into the four user-facing dimensions keeps the construct parsimonious without losing what matters for adoption. Treating these four parts as one construct matters, because it is their combination, and not any single tool, that lowers the barriers to using digital payments. This corrects the habit in earlier work of describing AI as a set of separate tools, and it supplies the single idea that the later propositions need.

The same capability also brings problems that remain unsettled, such as biased algorithms, a lack of transparency, unclear accountability, and weak privacy protection. These problems are larger in developing economies, where the rules governing AI are still immature (Truby et al., 2022; Shakil et al., 2025). They matter for the framework because they help explain why AI speeds up digital adoption without guaranteeing that cash will disappear. The people most exposed to the risks of AI are often the same people for whom cash offers protection.

2. The Growth of Digital Payments

Digital payment growth refers to the rising scale, depth, and reach of electronic transactions within a connected network of banks, fintech firms, telecommunication providers, and payment gateways. Studies consistently point to convenience, access, security, and efficiency as the main reasons people adopt digital payments (Daragmeh et al., 2021; Putrevu & Mertzanis, 2023), and recent evidence confirms that AI itself raises financial inclusion across income groups (Tian et al., 2025; Akanfe et al., 2025). The four parts of AI Capability act as accelerators of these reasons. Sensing and trust-building capability raise the sense of security, while adaptive capability makes services feel more useful and easier to use. In developing economies, mobile services extend this growth to people who sit beyond the reach of traditional banks (Senyo & Osabutey, 2020). The literature notes that growth is uneven and is held back by gaps in infrastructure and digital skills (Mhlanga, 2020). More importantly, the literature suggests that the growth of digital payments does not automatically diminish the role

of cash. This unexplained coexistence provides the conceptual foundation for the cash paradox developed in this study.

3. The Cash Paradox

The cash paradox describes a situation in which digital payments keep rising while demand for physical cash stays firm, contrary to the idea that one simply replaces the other. First, cash is a backup when technology fails, when networks or power go down, or when systems are attacked, which are the very failures that heavily digital systems are prone to (Bech et al., 2018). Second, cash offers privacy that data-driven systems cannot promise, a concern that grows as AI profiles user behaviour (Ozili, 2023). Third, cash stays central to informal economies where few merchants accept digital payments, and digital growth and a large cash-based informal sector are observed to persist together (Ly & Ly, 2024; Aguilar et al., 2024). Fourth, habit and inertia keep certain groups attached to cash (Rahman et al., 2021). These points reframe cash not as a leftover waiting to vanish, but as a tool that meets needs digital channels leave unmet. The paradox therefore challenges the belief that societies must move in a straight line toward a cashless state, and it supplies the explanation the literature has been missing.

The evidence on this paradox is not uniform, and the tensions in it are part of what the framework must explain. Studies disagree about how far cash will fall. Some report that rising card and wallet use is steadily displacing cash at the point of sale, while others find that cash in circulation keeps climbing in value even as its share of transactions falls (Bech et al., 2018; Ozili, 2023). The picture also differs sharply between richer and poorer economies. In several developed markets, strong infrastructure and high trust have allowed some countries to approach very low cash use, which is often read as proof that a cashless path is natural. In developing economies, by contrast, uneven networks, thin formal banking, large informal sectors, and lower digital trust keep cash central even where mobile payments spread quickly (Kamis, 2025; Ly & Ly, 2024; Senyo & Osabutey, 2020). One view treats leftover cash use as habit that will fade with time and education (Rahman et al., 2021). By contrast, this study argues that the continued reliance on cash reflects a rational response to enduring shortcomings in the resilience, privacy, and accessibility of digital payment systems (Ozili, 2023; Somogyvári, 2021). These contradictions highlight the limitations of replacement-based frameworks and demonstrate the need for a conceptual framework that recognises the cash paradox as an enduring feature of payment system evolution.

4. Hybrid Payment Ecosystems

The persistence of the cash paradox suggests that future payment systems are more appropriately conceptualised as hybrid ecosystems in which digital and physical payment methods coexist and are adopted according to contextual needs, trust, accessibility, and perceived risk. Hybrid systems are more resilient because they do not depend on a single infrastructure. AI-driven growth leads in formal transactions, while the paradox protects a role for cash, and the two are brought together within one system rather than set against each other. For developing economies in particular, a hybrid system is a realistic and workable path. It shifts the goal of policy away from removing cash and toward designing systems that connect both types of payment smoothly.

5. Conceptual Framework and Development of the Propositions

Table 2 brings the reviewed studies together. Rather than simply listing them, it groups them by the relationship each one helps explain within the framework. Taken as a whole, the evidence supports a clear direction. Studies of AI in finance show that capability drives adoption. Studies of digital growth confirm that use rises alongside cash demand that no one has fully explained. Studies of cash persistence and coexistence point toward a hybrid system as the outcome at the level of the whole market. This synthesis is the bridge from the literature to the conceptual framework shown in Figure 1, and it supports the three propositions set out below.

Table 2: Reviewed Studies Grouped by the Relationship to the Framework

Authors (Year)	Focus	Method	Key findings	Relationship to framework	Knowledge gap addressed
Mhlanga (2021)	AI and financial inclusion	Conceptual review	AI extends credit and services to the unbanked using alternative data.	Supports P1: AI Capability drives digital growth.	Shows AI widens access, but does not connect this to the survival of cash.
Kshetri (2021)	AI and inclusion in developing countries	Conceptual review	AI improves access but raises skill and regulatory concerns.	Defines the trust-building part of AI Capability.	Notes trust and regulation gaps that a single AI-capability construct can organise.
Königstorfer & Thalmann (2020)	AI in commercial banking	Systematic review	AI reshapes service delivery and decision processes.	Grounds the adaptive part of AI Capability.	Describes AI as separate applications rather than one underlying capability.
Daragmeh et al. (2021)	Digital payment adoption (COVID-19)	Survey / TAM	Usefulness and perceived risk shape intention to keep using.	Supports P1 adoption drivers.	Explains adoption but not why cash persists after adoption.
Senyo & Osabutey (2020)	Mobile money in emerging markets	Empirical	Mobile services reach people beyond bank infrastructure.	Links AI-driven growth to inclusion (P1 to P2).	Links reach to inclusion but not to the demand for cash.
Tian et al. (2025)	AI and financial inclusion nexus	Empirical (quantile-on-quantile)	AI significantly raises financial inclusion across the distribution.	Recent evidence for P1 across contexts.	Confirms the AI-inclusion link without addressing hybrid coexistence.
Akanfe et al. (2025)	AI and the financial inclusion landscape	Review	Maps current AI interventions and future directions for inclusion.	Positions AI Capability against the state of the field (P1).	Surveys interventions but stops short of a paradox-based mechanism.
Bech et al. (2018)	Cash demand across economies	Empirical / policy	Cash in circulation stays high despite digital growth.	Core evidence for the cash paradox (P2).	Documents persistence but offers no mechanism tying it to digital growth.
Aguilar et al. (2024)	Digital payments, informality, and growth	Empirical / policy	Digital payments and a large informal, cash-based sector coexist.	Evidence for the informal-economy channel (P2).	Shows coexistence but not how AI sharpens rather than removes it.
Ozili (2023)	CBDC, privacy, and cash	Conceptual	Privacy concerns keep demand for cash alive.	Explains the resilience of cash (P2).	Treats privacy in isolation from AI-driven adoption.

Ly & Ly (2024)	Digital payments in an emerging economy	Conceptual review	The informal economy sustains reliance on cash.	Supports the informal-economy channel (P2).	Explains reliance on cash but not its interaction with AI capability.
Rahman et al. (2021)	Cashless adoption behaviour	Empirical	Habit and inertia limit full replacement of cash.	Behavioural basis of the paradox (P2).	Frames cash use as habit, leaving its rational functions unexplored.
Somogyvári (2021)	Financial exclusion in digital systems	Conceptual	Going digital can leave vulnerable groups behind.	Motivates a hybrid system for inclusion (P3).	Warns of exclusion but proposes no integrating framework.
Shakil et al. (2025)	FinTech 5.0 ecosystems	Quantitative	AI, blockchain, and big data improve resilience and inclusion.	Supports the hybrid-system outcome (P3).	Describes resilient ecosystems without centring the cash paradox.
Truby et al. (2022)	AI governance in finance	Legal / conceptual	Weak AI rules increase risk in emerging markets.	A boundary condition on P1 to P3.	Identifies governance risk but not its link to hybrid design.

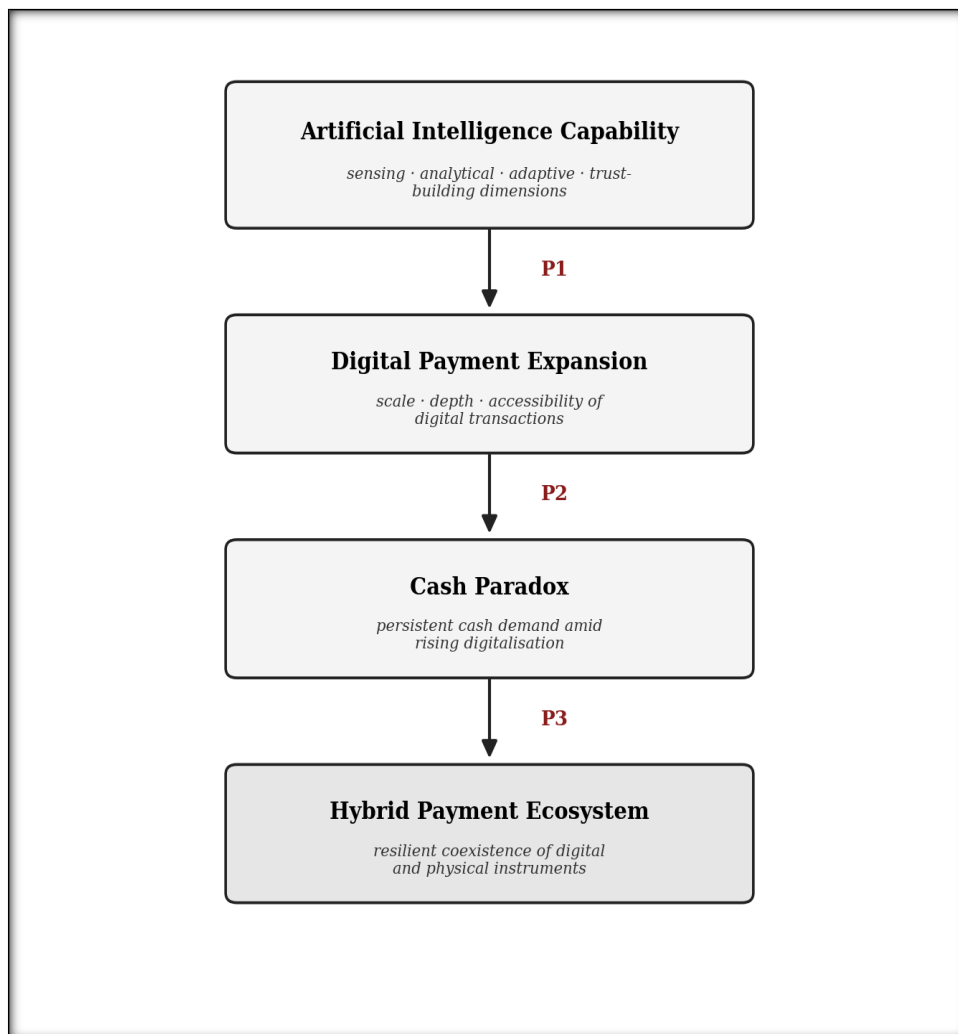


Fig. 1 The AI-Enabled Cash Paradox Framework

Proposition 1 (P1): Artificial Intelligence Capability positively influences the growth of digital payments.

The studies in Table 2 point in the same direction. The sensing and trust-building parts of AI Capability raise the sense of security, while the adaptive part makes payments feel more useful and easier to use. These are the very things that the Technology Acceptance Model and Diffusion of Innovations theory identify as drivers of adoption (Daragmeh et al., 2021; Königstorfer & Thalmann, 2020). The effects work together through one capability rather than through separate tools, AI Capability is treated as a positive driver of growth.

Proposition 2 (P2): The growth of digital payments positively influences the cash paradox. Contrary to the idea that digital simply replaces cash, the evidence suggests that as digital systems grow, their weaknesses and their appetite for personal data become more visible, which strengthens the protective role of cash (Bech et al., 2018; Ozili, 2023). Growth therefore does not end demand for cash. Instead, it brings out the conditions under which cash remains valuable, so the paradox becomes stronger rather than weaker.

Proposition 3 (P3): The cash paradox positively influences the rise of hybrid payment ecosystems. When the use of cash proves lasting and well grounded, sensible system design shifts from trying to remove cash toward bringing both methods together (Shakil et al., 2025; Somogyvári, 2021). Institutional theory suggests that regulators and financial institutions will make this coexistence formal through rules on interoperability and inclusion. A stronger and better-understood paradox is therefore expected to speed up the move toward hybrid systems.

METHODOLOGY

This study uses a conceptual, integrative review design that brings together theory and earlier evidence to build the AI-Enabled Cash Paradox Framework. No primary data are collected. To keep the process transparent and open to checking, and to make sure the review can be followed step by step, the search followed the PRISMA 2020 workflow across three stages: identification, screening, and eligibility. The full flow of records appears in Figure 2.

Search Strategy and Databases

The database searches were carried out between January and April 2026. Four databases were searched: Emerald Insight, Scopus, Web of Science, and Google Scholar. Scopus and Web of Science provided peer-reviewed coverage of finance, business, and information systems. Emerald Insight added depth on payments. Google Scholar was used only as a supplementary source to identify recent work, and its results were manually checked against the eligibility criteria. Boolean operators, phrase searching, truncation, and wildcards were applied across the title, abstract, and keyword fields. The search string was: ("artificial intelligence*" OR "AI in finance*" OR "machine learning*") AND ("digital payment*" OR "payment system*" OR "cashless society*" OR "cashless economy*" OR "e-wallet*" OR "fintech*") AND ("cash paradox*" OR "cash persistence*" OR "cash demand*") AND ("hybrid payment*" OR "financial inclusion*") AND ("developing economies*" OR "emerging markets*").

Reasons for the Time Window

The main search covered publications from January 2020 to April 2026. This window was chosen because the events of interest, namely the large-scale use of AI in payments, the surge in digital adoption during the pandemic, and the observed durability of cash, are concentrated in this period. The limit applies only to the empirical evidence. It does not apply to the theories that underpin the framework. The foundational works on the Technology Acceptance Model (Davis, 1989), Diffusion of Innovations (Rogers, 2003), and institutional theory (DiMaggio & Powell, 1983) were included regardless of their date, because the framework depends on them. Maintaining separate time windows ensures that the review captures recent empirical evidence while retaining the foundational theoretical works that underpin the proposed framework and its propositions.

Eligibility Criteria

Clear rules for including and excluding studies were set in advance and are summarised in Table 3. A study was included if it was a peer-reviewed journal article or an established conference paper, written in English, and

concerned with AI in finance, digital payment adoption, the persistence of cash, financial inclusion, or the evolution of payment systems, with relevance to developing economies. A study was excluded if it fell outside this scope, lacked academic rigour, dealt with an unrelated technology, or repeated findings already covered by another study in the pool.

Table 3: Eligibility Criteria

Criterion	Included	Excluded
Publication type	Peer-reviewed journal articles and established conference papers	Editorials, blogs, and non-refereed reports
Language	English	Non-English without a verified translation
Time window (evidence)	January 2020 to April 2026	Empirical studies before 2020
Time window (theory)	No limit for TAM, DOI, and institutional theory	None
Subject scope	AI in finance, digital payments, cash persistence, inclusion, and payment systems	Unrelated technology or sectors
Context	Global work relevant to developing economies	Studies with no relevant application
Quality	Clear method and clear contribution	Insufficient academic rigour

Screening, Removing Duplicates, and Selection

The identification stage returned 46 records from the four databases, plus 6 more found by tracing citations forward and backward. Because Scopus, Web of Science, Emerald Insight, and Google Scholar overlap extensively, the records were exported to a reference manager and checked for duplicates by matching the DOI, title, author, and year. Eight duplicates were removed, which left 44 unique records. The titles and abstracts were then screened against the eligibility criteria, and 15 records were excluded. The remaining 29 full-text articles were read in full, and a further 9 were excluded: 4 for being outside the scope, 3 for insufficient rigour, and 2 for repeating findings already covered. This left a final set of 20 studies for the review.

To keep the synthesis systematic rather than a matter of judgement alone, the 20 studies were analysed in three steps. In the first step, each study was coded against the four candidate ideas, namely AI Capability, digital payment growth, cash persistence, and hybrid ecosystems, and its main finding was recorded. In the second step, the codes were grouped to bring out the relationships that appeared repeatedly, such as the frequent pairing of digital growth with unexplained cash demand. In the third step, these relationships were arranged into a single direction and matched to the three theories, which produced the propositions and the framework in Figure 1. Table 2 presents the studies that most directly support each relationship, so the path from evidence to model can be followed and checked. Coding was carried out by two authors and reconciled with the third, using the same panel procedure applied at screening. New studies stopped adding new relationships well before the pool was exhausted, which is the sense in which the review reached saturation. In a conceptual review of this kind, saturation is reached when further studies confirm the existing relationships rather than reveal new ones, and this is why a focused set of 20 studies is sufficient to build and support the framework. Figure 2 shows the full process.

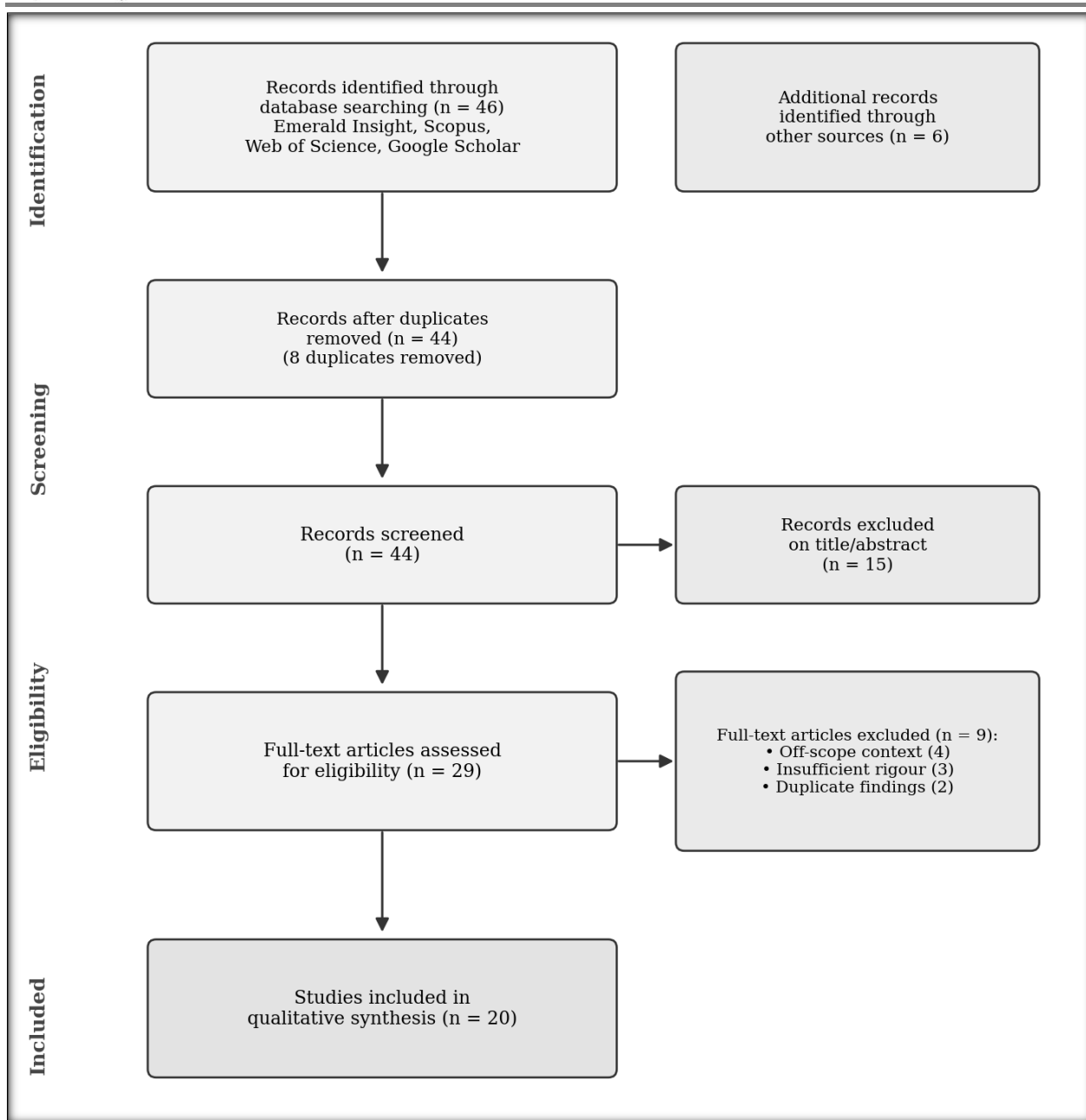


Fig. 2 PRISMA Flow Diagram of the Study Selection Process

Theoretical Foundations

Technology Acceptance Model

The Technology Acceptance Model holds that two beliefs shape whether people adopt a technology: how useful they think it is and how easy they think it is to use (Davis, 1989). In the payment setting, the model explains the uptake of mobile wallets, digital banking, and contactless cards. Accordingly, the adaptive and trust-building dimensions of AI Capability are conceptualised as antecedents of perceived usefulness and perceived ease of use, thereby establishing the theoretical rationale for Proposition 1 (P1).

Diffusion of Innovations Theory

Diffusion of Innovations theory explains how new ideas spread through five features: relative advantage, compatibility, complexity, trialability, and observability (Rogers, 2003). AI-enhanced payment systems offer a clear advantage in security, efficiency, and personalisation, which speeds up the spread and reinforces Proposition 1 (P1). The theory predicts slower spread where compatibility is low, which points to the persistence of cash captured in Proposition 2 (P2).

Institutional Theory

Institutional theory holds that behaviour is shaped by regulatory, normative, and cultural pressures (DiMaggio & Powell, 1983). Governments and central banks actively promote digital adoption, yet cultural preference, informal activity, and inequality keep cash in use. Institutional theory therefore explains why the two coexist, and, through rules on inclusion and interoperability, why hybrid systems become formal, as set out in Proposition 3 (P3).

RESULTS AND DISCUSSION

Rather than repeat the evidence already reviewed, this section draws out what the framework means and what it adds beyond current thinking. Three contributions follow from the synthesis.

The first contribution is that the framework changes the status of the cash paradox from an oddity into an explanation. The common view treats leftover cash demand as noise or as a passing problem that better technology will clear away. The AI-Enabled Cash Paradox Framework instead places the paradox at the centre of the model. The same AI capabilities that drive growth also raise the very concerns about privacy, resilience, and access that keep cash valuable. This is what the study means by reconceptualising the paradox. Cash moves from the position of a fading leftover to the position of a factor that helps decide how the system evolves. This is a clear break from earlier coexistence studies, which show that cash and digital payments both persist but never explain the mechanism that ties growth to persistence.

The second contribution is that treating AI Capability as a single construct with four parts changes what AI explains. In most payment research, AI appears as an operational aid, that is, one more tool for efficiency. By defining sensing, analytical, adaptive, and trust-building capability as one construct, the framework presents AI as strategic infrastructure that lowers the barriers to adoption and, at the same time, reshapes the risks against which people weigh the value of cash. This double role stays hidden when AI is described only as a list of applications, and it is what allows the framework to link P1 and P2 through a shared cause rather than through two unrelated trends.

The third contribution is that the framework reframes the objective of payment policy. Under a replacement model, success is measured by the decline of cash usage. In contrast, the proposed framework argues that, if the cash paradox is enduring, success should be assessed by the effectiveness with which cash and digital payments coexist within a resilient and inclusive payment ecosystem. The hybrid payment ecosystem is therefore not a compromise. It is the outcome the framework predicts for a system in which AI-driven digital growth and the enduring functions of cash are managed together. For developing economies, where AI rules are thinner and more people are digitally excluded, this shift has direct consequences for how modernisation should be defined and judged. Taken together, these theoretical arguments position the cash paradox as a meaningful phenomenon to be understood rather than eliminated, while providing a framework of empirically testable relationships. The value of the framework lies not in summarising what is already known, but in offering a mechanism that reorganises existing findings into an explanation of why digital growth and cash use rise together.

Contributions of the Study

Theoretical Contributions

The study makes three contributions to theory. It brings four separate bodies of research together into one framework. It defines AI Capability as a single construct rather than a list of applications. It raises the cash paradox to the level of an explanation, which supplies the reasoning that coexistence studies have lacked.

The proposed framework represents an integration of established theories rather than the development of a completely new theory or the extension of a single theoretical perspective. Specifically, it combines the Technology Acceptance Model (TAM), Diffusion of Innovations (DOI) Theory, and Institutional Theory into a unified framework, assigning each theory a distinct explanatory role. TAM is extended by conceptualising AI Capability as an antecedent that shapes perceived usefulness and perceived ease of use, rather than treating these

perceptions as inherent characteristics of technology. DOI Theory is broadened by explaining both the rapid diffusion of digital payments through relative advantage and observability, and the continued persistence of cash through compatibility with existing user preferences and payment contexts. Nonetheless, Institutional Theory is extended by demonstrating that regulatory, normative, and cultural pressures support not only digital payment adoption but also the institutionalisation of cash, thereby reinforcing the long-term coexistence of both payment methods. Collectively, these theoretical extensions produce an integrated framework capable of explaining the emergence and persistence of hybrid payment ecosystems, a phenomenon that cannot be fully explained by any single theory alone.

Policy Implications

Policymakers should shift the focus of payment system development from achieving a cashless society to enhancing system efficiency, resilience, accessibility, and financial inclusion. Robust AI governance is essential to address bias, transparency, accountability, privacy, and cybersecurity concerns that underpin public trust. At the same time, central banks should maintain cash infrastructure as a critical component of financial resilience and emergency preparedness while encouraging interoperability between cash and digital payment systems. Inclusive policies should ensure equitable access to both payment channels, thereby supporting the long-term sustainability of a hybrid payment ecosystem.

Managerial Implications

Financial institutions and fintech firms should position AI as a strategic organisational capability by strengthening its sensing, analytical, adaptive, and trust-building dimensions. Rather than pursuing a fully cashless model, payment strategies should be designed to support the coexistence of cash and digital payment methods while accommodating diverse user needs and transaction contexts. Furthermore, greater emphasis should be placed on transparency, cybersecurity, and user education to enhance trust, promote inclusive adoption, and prevent the exclusion of individuals who continue to depend on cash.

CONCLUSION AND FUTURE RESEARCH

This conceptual paper set out to address the scattered nature of the payment literature by bringing artificial intelligence, digital payment growth, the cash paradox, and hybrid payment ecosystems together within one framework. Drawing on the Technology Acceptance Model, Diffusion of Innovations theory, and institutional theory, and reviewing twenty studies through a transparent, PRISMA-guided search, it developed the AI-Enabled Cash Paradox Framework. The framework presents AI Capability as a single driver of digital growth, treats the cash paradox as the link between growth and the persistence of cash, and identifies the hybrid payment ecosystem as the outcome at the level of the whole system. A few limits point the way to future work. The framework is conceptual and needs to be tested, and the next step is to turn it into a measurement model. AI Capability can be operationalised as a second-order construct with four first-order dimensions, each captured by several survey items rated on a seven-point Likert scale. Future research should focus on empirically validating the proposed AI-Enabled Cash Paradox Framework by testing the relationships among the key constructs. This could involve developing reliable and valid measurement scales for AI Capability dimensions and examining their direct and indirect effects on payment behaviour through structural equation modelling (SEM). Comparative studies across countries and payment ecosystems would further enhance the framework's generalisability and provide deeper insights into contextual differences in AI-driven payment adoption.

REFERENCES

1. Aguilar, A., Frost, J., Guerra, R., Kamin, S., & Tombini, A. A. (2024). Digital payments, informality and economic growth (BIS Working Paper No. 1196). Bank for International Settlements.
2. Akanfe, O., Bhatt, P., & Lawong, D. A. (2025). Technology advancements shaping the financial inclusion landscape: Present interventions, emergence of artificial intelligence and future directions. *Information Systems Frontiers*. <https://doi.org/10.1007/s10796-025-10597-z>
3. Bech, M. L., Faruqui, U., Ougaard, F., & Picillo, C. (2018). Payments are a-changin' but cash still rules. *BIS Quarterly Review*, March, 67–80.

4. Bello, O. A., & Olufemi, K. (2024). Artificial intelligence in fraud prevention: Exploring techniques and applications, challenges and prospects. *Computer Science and IT Research Journal*, 5(6), 1505–1520. <https://doi.org/10.51594/csitrj.v5i6.1252>
5. Daragmeh, A., Sagi, J., & Zeman, Z. (2021). Continuous intention to use e-wallet in the context of the COVID-19 pandemic: Integrating the Health Belief Model and the Technology Continuous Theory. *Journal of Open Innovation: Technology, Market, and Complexity*, 7(2), 132. <https://doi.org/10.3390/joitmc7020132>
6. Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly*, 13(3), 319–340. <https://doi.org/10.2307/249008>
7. DiMaggio, P. J., & Powell, W. W. (1983). The iron cage revisited: Institutional isomorphism and collective rationality in organizational fields. *American Sociological Review*, 48(2), 147–160. <https://doi.org/10.2307/2095101>
8. Kamis, R. (2025). Digital Financial Inclusion and Payment Growth : A Comparative Assessment of Malaysia and Indonesia. *International Journal of Research and Innovation in Social Science*, IX(2454), 4708–4719. <https://doi.org/10.47772/IJRISS>
9. Konigstorfer, F., & Thalmann, S. (2020). Applications of artificial intelligence in commercial banks: A research agenda for behavioral finance. *Journal of Behavioral and Experimental Finance*, 27, 100352. <https://doi.org/10.1016/j.jbef.2020.100352>
10. Kshetri, N. (2021). The role of artificial intelligence in promoting financial inclusion in developing countries. *Journal of Global Information Technology Management*, 24(1), 1–6. <https://doi.org/10.1080/1097198X.2021.1871273>
11. Ly, R., & Ly, B. (2024). Digital payment systems in an emerging economy. *Computers in Human Behavior Reports*, 16, 100517. <https://doi.org/10.1016/j.chbr.2024.100517>
12. Mhlanga, D. (2020). Industry 4.0 in finance: The impact of artificial intelligence on digital financial inclusion. *International Journal of Financial Studies*, 8(3), 45. <https://doi.org/10.3390/ijfs8030045>
13. Mhlanga, D. (2021). Financial inclusion in emerging economies: The application of machine learning and artificial intelligence in credit risk assessment. *International Journal of Financial Studies*, 9(3), 39. <https://doi.org/10.3390/ijfs9030039>
14. Muthusamy, G., Awang, A. H., Harun, H., Kamis, R., Bahtar, A. Z., Yazid, Z. A., & Daud, S. (2024). Modeling the technology readiness index for the adoption of mobile payment technologies during the COVID-19 pandemic. *AIP Conference Proceedings*, 2799(1). <https://doi.org/10.1063/5.0183139>
15. Ozili, P. K. (2023). Central bank digital currency, cryptocurrency, privacy and the persistence of cash. In *Digital transformation and the economics of banking* (pp. 1–18). Routledge. <https://doi.org/10.4324/9781003340591>
16. Purwatiningsih, A. P. (2025). Adoption of QRIS digital payment in Indonesia and Malaysia: A technology acceptance and knowledge perspective. *International Journal of Innovative Research and Scientific Studies*, 8(6), 704–713. <https://doi.org/10.53894/ijirss.v8i6.9670>
17. Putrevu, J., & Mertzanis, C. (2023). The adoption of digital payments in emerging economies: Challenges and policy responses. *Digital Policy, Regulation and Governance*, 26(5), 476–500. <https://doi.org/10.1108/DPRG-06-2023-0077>
18. Rahman, M., Ismail, I., & Bahri, S. (2021). Analysing consumer adoption of cashless payment in Malaysia. *Digital Business*, 1(1), 100004. <https://doi.org/10.1016/j.digbus.2021.100004>
19. Rogers, E. M. (2003). *Diffusion of innovations* (5th ed.). Free Press.
20. Senyo, P. K., & Osabutey, E. L. C. (2020). Unearthing antecedents to financial inclusion through FinTech innovations. *Technovation*, 98, 102155. <https://doi.org/10.1016/j.technovation.2020.102155>
21. Shakil, M., Ali, M., Illahi, T., & Ahmed, F. (2025). FinTech 5.0 and the future of global finance: Harnessing artificial intelligence, blockchain, and big data to build inclusive, sustainable, and resilient financial ecosystems. *Inverge Journal of Social Sciences*, 4(4), 56–66. <https://doi.org/10.63544/ijss.v4i4.179>
22. Siregar, E. S., Sagantha, F., Ridho, M. T., Kamis, R., & Rizkiana, I. (2026). Contract-Specific Effects of Fintech on Islamic Financing Profitability. *Journal of Islamic Economics and Finance*, 15(1), 450–467. <https://doi.org/10.22373/share.0011>
23. Somogyvari, M. (2021). Financial exclusion and the cashless society. *Public Finance Quarterly*, 66(Special Edition), 108–124.

24. Tian, Y., Zhu, D., Nazar, R., Ali, S., & Mirza, A. (2025). From algorithms to access: Role of artificial intelligence in revolutionizing financial inclusion. *Technology in Society*, 83, 102962. <https://doi.org/10.1016/j.techsoc.2025.102962>
25. Truby, J., Brown, R. D., Dahdal, A., & Ibrahim, I. (2022). Governing artificial intelligence to benefit the UN Sustainable Development Goals. *Sustainable Development*, 30(5), 946–959. <https://doi.org/10.1002/sd.2260>