Financial Technology and Innovation

♦ **ISSN:** 2836-5372 **Vol:** 06, No. 02, 2026 ♦ PP. 01–08

Article DOI: https://doi.org/10.54216/FinTech-I.060201

FULL LENGTH ARTICLE

From Connectivity to Use: An Innovation-Conversion Model of Digital Finance Across Developing Economies

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Received: January 07, 2026 Revised: February 28, 2026 Accepted: May 13, 2026 ⋆ Corresponding author

ABSTRACT

Digital connectivity has grown more rapidly than people's engagement with formal digital finance, creating a policy gap beyond mere device, account and network coverage. This article proposes an innovation-conversion framework to approximate the effectiveness of the enabling conditions to be translated into digital-payment usage. Six cross-sections are set up as non-competing predictive specifications, repeated cross-validation, out-of-fold benchmarking, regional stress tests and unsupervised archetype mapping to analyse a harmonized 2024 cross-section of 74 low and middle-income economies. The top performing Elastic Net specification achieved a mean cross-validated R^2 of 0.867, an out-of-fold R^2 of 0.881, and a mean absolute error of 5.23 percentage points. The signal from account ownership was the predominant one, with additional information coming from mobile internet access, self-reported exposure to internet fraud, and internet-skill constraints. The proposed conversion-gap index defines the economies where the actual use of payments significantly under- or over-performs what is expected given the enabling environment. The positive converters were Mongolia, the Republic of Congo, Lesotho and Venezuela, while the largest negative gaps were in India, Ethiopia, Nepal, Sri Lanka and the West Bank and Gaza. Mature digital-use systems, use lagging access-rich systems, mobile-led transitions and foundational access gaps are four structural archetypes that further distinguish the mature systems. The findings change the perception of financial innovation as a conversion issue: infrastructure is important, but institutional onboarding, accessible accounts, building of trust, security, and capabilities will be the keys to making connectivity a commonplace financial transaction.

Keywords: Digital financial inclusion ▪ Financial innovation ▪ Digital payments ▪ Connectivity ▪ Global Findex ▪ Explainable prediction ▪ Emerging economies

1. INTRODUCTION

The expression of inclusion has been changed.The meaning of inclusion has changed in practice. They can have a smartphone, be online regularly, and have an account with money without using a digital interface, without paying for it, or without any need for an account. This leaves a gap between technical availability and sustainable financial use that is consequential for banks, payment companies, regulators, and governments. Application of investment in connectivity and account opening can lead to poor usage when products are hard to navigate, consumers don't trust digital channels, there is salient exposure to fraud, or account design doesn't align with recurring transactions.

Recent research has established facts of fast expansion of digital finance, differential uptake and differential impacts on welfare. While digital channels can generate cost savings and reach, they rely on the capacity, design and consumer protection of such channels [1, 2, 3]. Research on cross-country indices has enhanced the measurement of digital financial inclusion [4, 5] and research on household studies has shown the relationship between digital and financial knowledge and payment uptake, resilience and well-being [6, 7, 8]. What is not well developed is a country-level indicator to measure efficiency of using existing enabling conditions to stimulate actual digital-payment behavior.

This is significant because access does not equal use. These can include a dormant account, using the internet for purposes other than financial, not feeling confident in using the internet for financial transactions or being aware of a reported fraud, which may be a result of risk and/or higher exposure to digital systems. An innovation measure should therefore be based on a multivariate expectation, instead of a single input or output.

This study proposes an *innovation-conversion gap* defined as the disparity between observed digital-payment participation and predictions beyond the scope of the fold, which are based on account access, connectivity, digital capability, trust, safety-exposure and emergency-resilience. Positive values are indicative of economies that achieve more than the economy would be expected to, given what is observed about its enabling conditions. Negative values represent latent capacity or institutional friction. The design is intentionally a prediction, not a cause. Its intent is to provide a disciplined cross-country sample interpretable comparative benchmark.

Three contributions follow. First, the analysis combines new connectivity and digital-safety indicators from the 2024 Global Findex wave with existing indicators of account usage and resilience. Second, it provides a comparison between linear and regularized specifications and tree-based specifications via repeated validation and has out-of-fold estimates for country assessment without relying on in-sample rankings. Third, it integrates conversion gaps and regional holdout tests with four data-based archetypes, creating a diagnostic framework that can inform product strategy and policy sequencing.

2. CONCEPTUAL BACKGROUND AND RELATED EVIDENCE

2.1 Access is a necessary input, not a realized outcome

The literature increasingly separates traditional financial access from digitally mediated use. The distinction is visible in index construction, where breadth, depth, and digital intensity capture different dimensions [4, 5]. It also appears in evidence that fintech-supported inclusion can alter bank risk-taking [9], entrepreneurship [10], growth quality [11], and resilience [12]. These effects presuppose more than physical or legal access; they require recurrent, trusted transactions.

The conversion perspective treats infrastructure as productive capacity. Connectivity, accounts, and devices create an opportunity set. Actual use emerges when service design, consumer capability, perceived value, and institutional safeguards allow that capacity to be activated. This view is consistent with adoption research in which trust is a recurrent motivator and perceived risk a recurrent inhibitor [13]. It also explains why similar levels of connectivity can coexist with very different payment behavior.

2.2 Capability, trust, and risk shape the conversion process

Digital inequality is multidimensional. Access gaps interact with differences in skills, purposes of use, and realized outcomes [14, 15]. The financial setting intensifies this interaction because errors have immediate economic consequences. Evidence from low-income communities shows that digital skills are linked to financial inclusion [16]; cross-country and household studies similarly associate financial and digital literacy with payment use, saving, resilience, and well-being [17, 7, 18, 8].

Trust and safety are not simple opposites. High reported exposure to fraud may indicate weak protection, but it may also occur where digital engagement is already widespread. Aggregate country measures can therefore contain an exposure component: more active users create more opportunities to encounter attempted fraud. This is one reason the present design interprets predictors as diagnostic signals rather than causal levers. Explainable modeling is used to show which variables carry predictive information, not to imply that increasing a risk indicator would improve use [19, 20].

2.3 Related work and unresolved gap

Table 1 summarizes representative studies published since 2020. Existing research has supplied valuable adoption models, multidimensional indices, regional estimates, and welfare analyses. Most work, however, either explains inclusion as an outcome, estimates causal or associational effects within a specific setting, or constructs a composite index. Few studies ask whether observed digital-finance use is high or low *relative to the enabling conditions already present* and protect that comparison with out-of-fold prediction.

2.4 Research questions

The study is organized around four questions:

RQ1. How accurately can observable access, connectivity, capability, trust, safety, and resilience indicators predict cross-country digital-payment use?

RQ2. Which enabling conditions provide the largest incremental predictive contribution?

RQ3. Which economies over-convert or under-convert their observable conditions into active use?

RQ4. Do economies form distinct innovation archetypes that imply different intervention priorities?

3. ANALYTICAL STRATEGY

3.1 Data and analytical sample

The 2025 Global Findex edition reports nationally representative survey evidence collected during 2024 and introduces a Digital Connectivity Tracker covering mobile ownership, internet use, digital safety, and selected skills [23]. The analytical unit is the economy-level estimate for adults aged 15 and above. The initial 2024 country file was restricted to total-population observations, low- and middle-income economies, and complete information on the outcome and eleven predictors. One high-income observation was excluded to maintain a comparable development scope. The resulting sample contains 74 economies across six regions: 34 in Sub-Saharan

Table 1. Representative recent work on digital financial inclusion and the gap addressed here

Study	Setting and data	Method	Main focus or finding	Limitation relative to the present study
[1]	FinTech and inclusion context	Qualitative theory development	Identifies institutional and technological antecedents of inclusion	Does not produce a cross-country conversion benchmark
[2]	Bangladesh	National evidence and synthesis	Reframes inclusion around digitally enabled participation	Single-country focus
[9]	OIC countries	Cross-country panel modeling	Links fintech-based inclusion to bank risk-taking	Institutional outcome rather than consumer use conversion
[4]	Emerging and developing economies	Multidimensional index construction	Develops a digital financial inclusion index	Composite ranking does not estimate expected use
[21]	MENA economies, 2017 Findex	Probit estimation	Connects cashless policy and demographics to digital services	Earlier wave and individual adoption focus
[6]	Cross-country personal finance evidence	Econometric analysis	Relates digital and financial literacy to digital payments	Does not model institutional conversion efficiency
[7]	Seven South Asian and African countries	Survey-based multivariate analysis	Links multidimensional literacy to resilience-building behavior	Limited country coverage and household focus
[5]	International panel	Trend and driver analysis	Compares traditional and digital inclusion	Explains levels rather than out-of-fold over- or under-conversion
[22]	56 emerging countries, 2011–2021	Two-step system GMM	Finds heterogeneous effects of digital literacy and technology adoption	Predates the 2024 connectivity tracker
[12]	13 emerging economies	Comparative panel analysis	Assesses traditional and digital inclusion effects on resilience	Small outcome-specific panel; no country diagnostic gap

The table emphasizes design differences rather than attempting an exhaustive review. The present study uses out-of-fold prediction to benchmark realized digital-payment use against observable enabling conditions.

Table 2. Analytical variables

Construct	Operational measure
Active use	Made or received a digital payment
Financial access	Owns an account at a financial institution or mobile-money provider
Connectivity	Recent internet use; smartphone ownership; internet access on phone
Access barriers	Internet is too expensive; lacks skills to use internet
Trust and safety	Trusts digital payments; experienced an online fraud attempt
Digital capability	Can send email; can protect privacy online
Resilience	Could obtain emergency funds

Africa, 16 in Latin America and the Caribbean, eight in East Asia and the Pacific, seven in the Middle East and North Africa, five in South Asia, and four in Europe and Central Asia.

The outcome is the share of adults who made or received a digital payment. Predictors capture account ownership, recent internet use, smartphone ownership, internet access through a mobile phone, cost and skill barriers to internet use, trust in digital payments, ability to send email, ability to protect privacy online, exposure to an attempted online fraud, and the ability to raise emergency funds. All variables are proportions on the unit interval.

Figure 1 presents the analytical logic and sample composition. The framework does not assume a single linear adoption sequence. It recognizes feedback between use and reported exposure, while locating the conversion benchmark between enabling inputs and realized payment behavior.

3.2 Model comparison

Let y_i denote digital-payment use in economy i, and let $\mathbf{x}_i$ contain the eleven enabling indicators. Six specifications were compared:

$$y_i = f_m(\mathbf{x}_i) + \varepsilon_i, \qquad m = 1, \ldots, 6, \tag{1}$$

comprising ordinary least squares, Ridge, Elastic Net, Random Forest, Extra Trees, and Gradient Boosting. Continuous inputs were standardized for the linear models. The Elastic Net penalty combines L_1 and L_2 shrinkage,

$$\min_{\beta} \frac{1}{2n}\|\mathbf{y} - \mathbf{X}\beta\|_2^2 + \alpha\left[\rho\|\beta\|_1 + \frac{1-\rho}{2}\|\beta\|_2^2\right], \tag{2}$$

with $\alpha = 0.005$ and $\rho = 0.10$. These conservative settings were fixed before repeated evaluation to limit variance in the small cross-country sample.

Performance was assessed using five-fold cross-validation repeated three times with a fixed reproducibility seed. The ranking criteria were mean R^2, mean absolute error (MAE), and root mean squared error (RMSE). A separate shuffled ten-fold procedure generated one prediction for every economy from a model that had not been fitted on that economy.

3.3 Conversion-gap index

The innovation-conversion gap is defined as

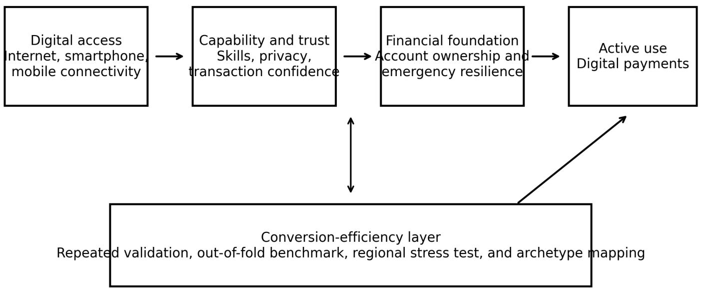
$$G_i = y_i - \widehat{y}_{i,-k}, \tag{3}$$

where $\widehat{y}_{i,-k}$ is the out-of-fold prediction for economy i. $G_i > 0$ denotes above-benchmark conversion and $G_i < 0$ denotes below-benchmark conversion. Because both terms are proportions, $100G_i$ is interpretable in percentage points. The index is relative, not normative: it does not state that the predicted level is socially optimal, only that it is the level associated with comparable observable conditions in the sample.

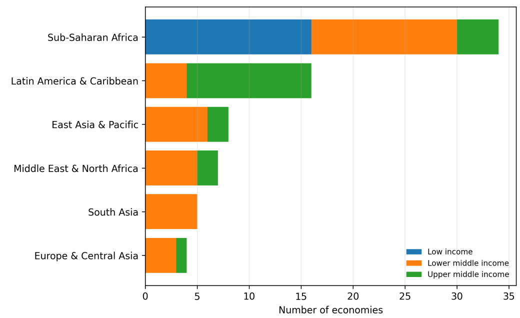
3.4 Interpretation, stress testing, and archetypes

Permutation importance measured the decline in fitted R^2after each feature was randomly disrupted. Response curves then varied the three most important predictors across their observed central range while averaging predictions over the remaining economy profiles. These devices reveal model dependence but do not identify causal effects.

Regional portability was assessed by leaving one region out, fitting the selected model on the other five, and predicting the omitted region. Finally, k-means clustering with $k = 4$ was applied to standardized account ownership, internet use,



(a) Innovation-conversion framework



(b) Analytical sample by region and income group

Figure 1. Study design and sample structure.

digital-payment use, payment trust, and emergency resilience. Principal components provide a two-dimensional view of the resulting archetypes.

4. EMPIRICAL FINDINGS

4.1 The connectivity–use landscape

Across the 74 economies, mean digital-payment participation was 47.9%, compared with 56.5% account ownership, 59.4% recent internet use, and 55.3% smartphone ownership. These averages already signal that the three forms of access do not align mechanically. The mean skill barrier to internet use was 17.6%, the mean cost barrier 16.3%, and reported trust in digital payments 42.0%.

Regional contrasts were substantial. Europe and Central Asia recorded the highest mean digital-payment use (59.5%), followed by East Asia and the Pacific (57.4%) and Sub-Saharan Africa (50.0%). Latin America and the Caribbean averaged 48.2%, South Asia 36.5%, and the Middle East and North Africa 28.0%. The latter region combined relatively high internet use (77.3%) with low account ownership (37.8%), illustrating why connectivity alone is an incomplete proxy for financial innovation. Sub-Saharan Africa showed the reverse pattern: internet use averaged 40.3%, yet digital-payment participation reached 50.0%, consistent with mobile-money ecosystems that can support transactions under lower general internet penetration.

Figure 2 reinforces two observations. First, connectivity and payment use are positively associated, but dispersion is wide. Second, regions overlap substantially, cautioning against a single regional development sequence.

4.2 Predictive performance

Table 3 reports repeated cross-validation results. Elastic Net ranked first with mean R^2=0.867, MAE=0.0523, and RMSE=0.0665. Ridge and ordinary least squares were close, whereas the tree ensembles were less accurate and more variable. The result favors a largely additive structure with shrinkage rather than complex nonlinear partitioning. It also supports interpretability: the modest sample does not reward highly flexible learners.

The stricter ten-fold out-of-fold predictions yielded R^2=0.881, MAE=5.10 percentage points, and RMSE=6.61 percentage

Table 3. Repeated five-fold cross-validation

Model	Mean R^2	MAE	RMSE
Elastic Net	**0.867**	**0.052**	**0.067**
Ridge	0.865	0.053	0.067
OLS	0.862	0.054	0.068
Extra Trees	0.835	0.056	0.074
Random Forest	0.805	0.061	0.080
Gradient Boosting	0.797	0.061	0.082

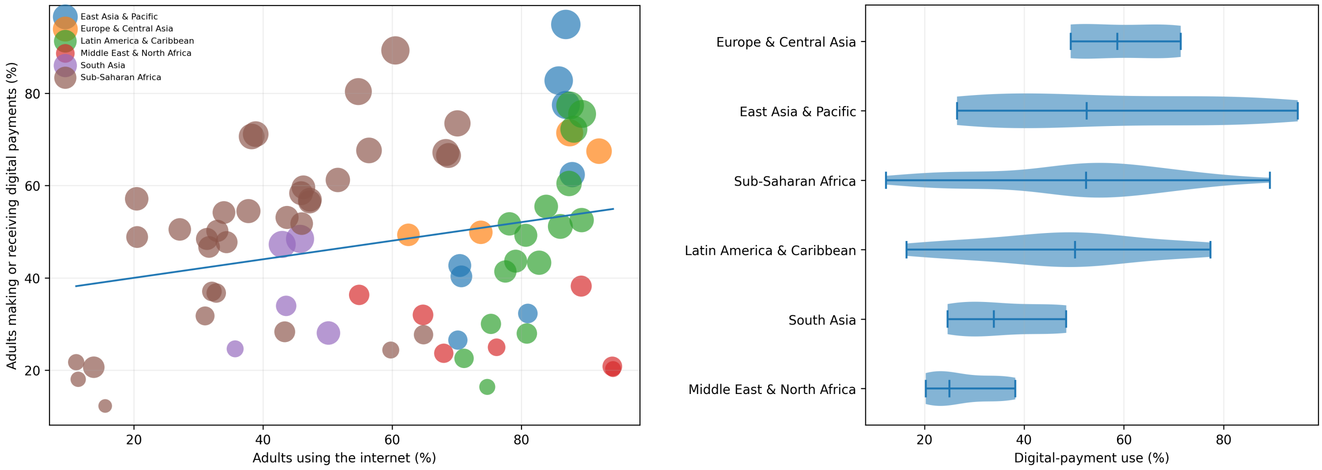
points. Figure 3 shows both the resampling distributions and the observed–predicted relationship. Errors are visible at both ends of the distribution, but no broad calibration collapse appears.

4.3 What carries predictive information?

Account ownership dominated permutation importance (Figure 4a). Disrupting it reduced fitted $R^2$by 1.190 on average, far more than any other variable. Attempted online fraud was the second signal (0.164), followed by the internet-skill barrier (0.047), mobile internet access (0.046), and smartphone ownership (0.011). The standardized Elastic Net coefficient for account ownership was 0.145; the coefficients for attempted fraud, mobile internet access, and the skill barrier were 0.055, 0.030, and 0.030, respectively.

The signs require careful interpretation. At country level, fraud attempts and skill barriers are partly exposure measures: residents can report digital threats and limitations only when digital channels are sufficiently present to be encountered. Their positive coefficients should not be read as beneficial effects. Rather, they help discriminate between low-use environments with little exposure and more digitally active environments in which risk and capability problems become observable.

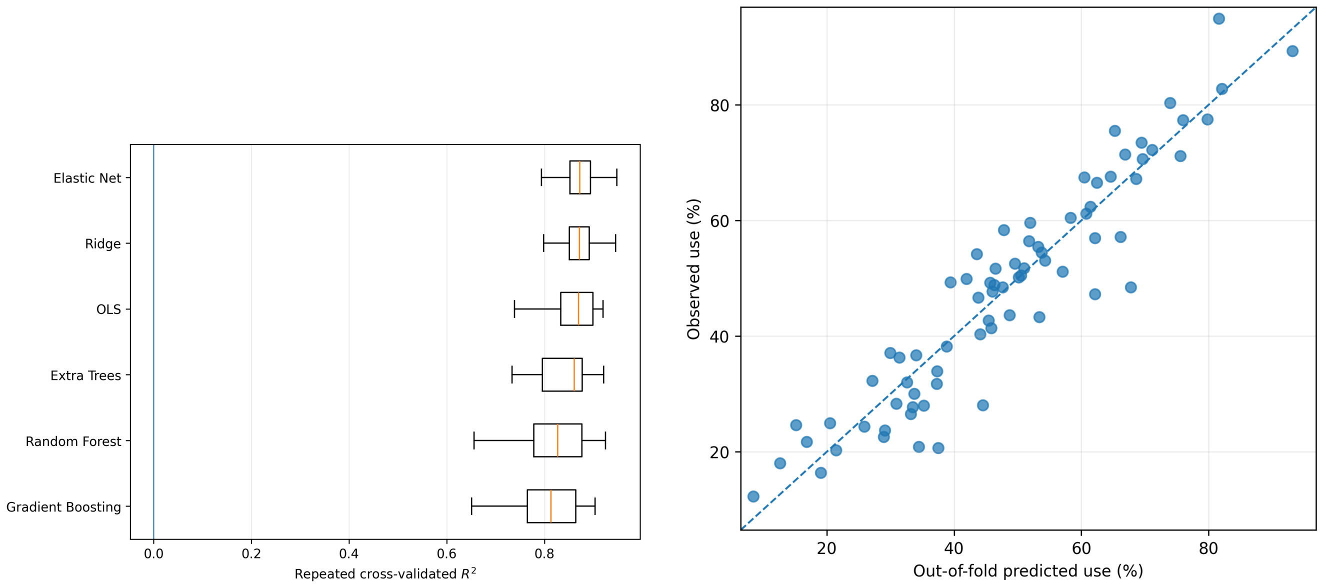
The response curves in Figure 4b show a steep, nearly monotonic association between account ownership and expected payment use. The other two leading signals shift predictions more moderately. The practical message is not that accounts automatically create use, but that routine digital payments are difficult to scale without an account base that is usable for transaction flows.



(a) Internet use and digital-payment participation; bubble size denotes account ownership

(b) Regional distribution of digital-payment use

Figure 2. Connectivity and realized digital-finance use.



(a) Distribution of repeated cross-validated R^2

(b) Observed and out-of-fold predicted use

Figure 3. Comparative performance and out-of-fold calibration.

4.4 Innovation-conversion gaps

The largest positive conversion gaps were observed in Mongolia (+13.3 percentage points), the Republic of Congo (+10.6), Lesotho (+10.5), Venezuela (+10.3), and Tajikistan (+9.9). These economies achieved materially higher digital-payment participation than predicted from the full set of observable conditions. Their advantage may reflect unmeasured institutional features such as interoperable payment rails, government transfers, concentrated mobile-money networks, merchant acceptance, or product designs that fit common transactions.

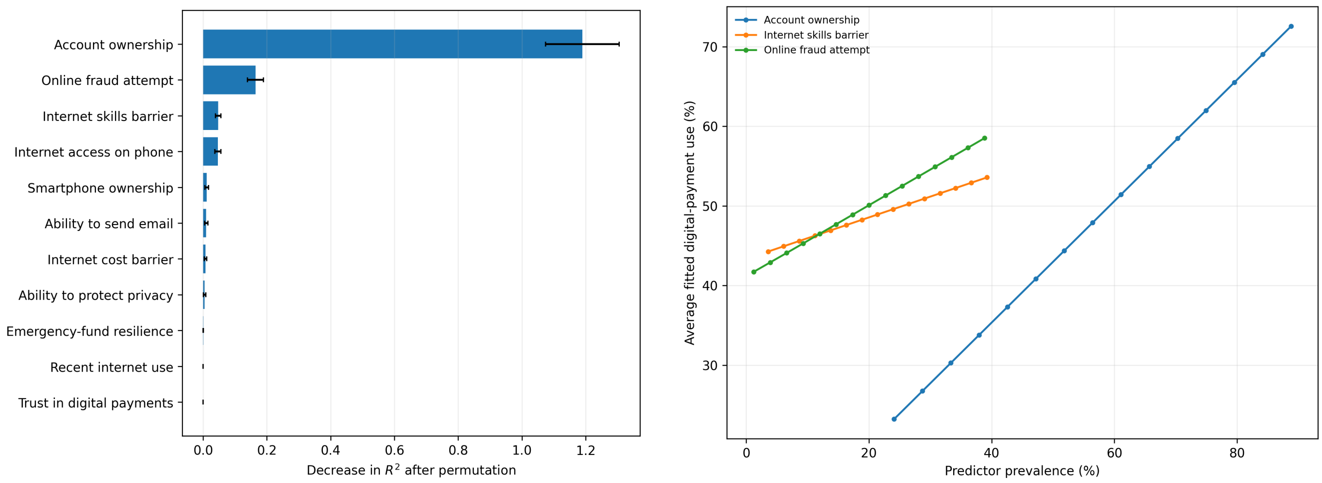
The largest negative gaps were India (-19.3 percentage points), Ethiopia (-16.8), Nepal (-16.4), Sri Lanka (-14.8), and the West Bank and Gaza (-13.6). A negative gap does not imply absent innovation. It indicates that the measured access and connectivity base has not translated into payment use at the rate observed elsewhere. In these settings, the next marginal investment may need to prioritize activation, merchant-side acceptance, recurring-use cases, transparent pricing, trust repair, or consumer support rather than device diffusion alone.

Table 4. Largest positive and negative conversion gaps

Economy	Observed (%)	Gap (pp)
Mongolia	94.9	+13.3
Congo, Rep.	54.2	+10.6
Lesotho	58.4	+10.5
Venezuela, RB	75.5	+10.3
Tajikistan	49.3	+9.9
West Bank and Gaza	25.6	-13.6
Sri Lanka	35.0	-14.8
Nepal	27.9	-16.4
Ethiopia	12.3	-16.8
India	34.8	-19.3

4.5 Regional portability and structural archetypes

Leaving entire regions out is a demanding test because the model cannot learn region-specific patterns from the omitted group. Pooled leave-region-out performance remained informative (R^2=0.695; MAE=8.44 percentage



(a) Permutation importance

(b) Model-implied response curves for the three strongest predictors

Figure 4. Interpretation of the selected Elastic Net model.

Table 5. Profiles of the four digital-finance innovation archetypes

Archetype	*n*	Profile (%)
Foundational access gap	22	Account: 44.0; Internet: 76.2; Digital payment: 33.2; Trust: 52.1; Emergency resilience: 90.9
Mobile-led transition	27	Account: 49.8; Internet: 34.1; Digital payment: 42.9; Trust: 22.3; Emergency resilience: 92.5
Mature digital use	17	Account: 79.5; Internet: 80.3; Digital payment: 71.9; Trust: 61.6; Emergency resilience: 92.6
Access-rich, use-lagging	8	Account: 64.8; Internet: 54.1; Digital payment: 54.7; Trust: 39.3; Emergency resilience: 76.4

points; RMSE=10.59 percentage points), but portability varied. Predictions were strongest for East Asia and the Pacific (MAE=4.74 percentage points) and Latin America and the Caribbean (4.69), moderate for the Middle East and North Africa (4.85), and weakest for South Asia (16.65) and Sub-Saharan Africa (10.57). The negative South Asian regional R^2reflects a small five-economy group with several large under-conversion cases, not a general failure of the full-sample model.

The clustering exercise identifies four archetypes. The *mature digital-use* group contains 17 economies and averages 79.5% account ownership, 80.3% internet use, 71.9% digital-payment use, and 61.6% payment trust. The *foundational access-gap* group contains 22 economies: internet use is comparatively high (76.2%), but account ownership (44.0%) and payment use (33.2%) lag. The *mobile-led transition* group contains 27 economies, with low general internet use (34.1%) but payment use of 42.9%, suggesting alternative channel structures. The eight *access-rich, use-lagging* economies average 64.8% account ownership and 54.7% payment use but display the lowest emergency-resilience level (76.4%).

5. INTERPRETATION AND INSTITUTIONAL IMPLICATIONS

5.1 Financial innovation should be managed as a conversion portfolio

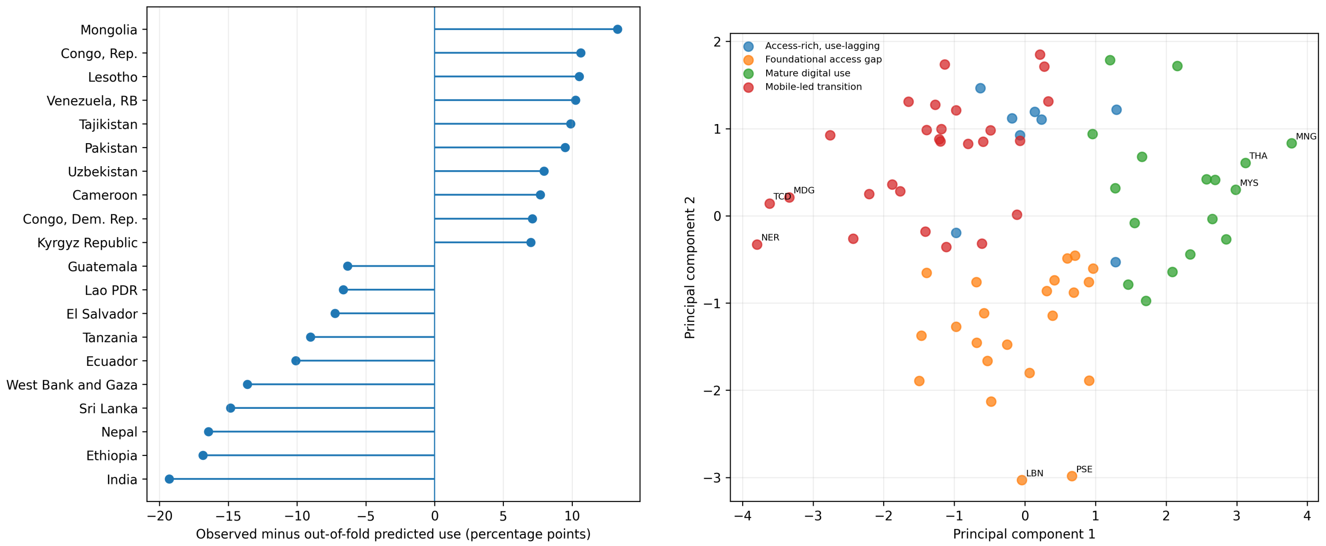
A central implication is that financial-sector modernization should not be evaluated through isolated input targets. Connectivity programs, digital identity, account opening, merchant acceptance, instant-payment rails, and financial education are complements whose bottleneck changes by archetype. A mature system may benefit most from safety, competition, and deeper product use. A foundational access-gap system needs reliable account onboarding and transaction propositions despite already meaningful connectivity. A mobile-led transition requires interoperability and a pathway from basic transfers to savings, merchant payments, and formal credit. An access-rich but use-lagging system needs activation: consumers already possess some infrastructure but do not use it as intensively as comparable economies.

This portfolio view refines the common assumption that more digital infrastructure will automatically create inclusion. The strong role of account ownership indicates that the financial layer remains indispensable. Internet access can reduce search and distribution costs, but an account that is difficult to fund, expensive to use, or weakly accepted will not become a routine payment instrument. The policy objective should therefore move from nominal ownership to transaction-ready ownership.

5.2 Implications for banks and payment providers

For providers, the conversion gap can serve as a market-diagnostic screen. Negative-gap economies may contain underused customer bases where acquisition has outpaced engagement. The relevant product metrics are then activation within 30 or 90 days, recurring payment frequency, successful first transactions, merchant acceptance density, failure rates, and resolution time after fraud or error. Positive-gap economies warrant case study because they may reveal low-cost design patterns that compensate for weaker infrastructure.

The archetypes also suggest different innovation priorities. In foundational access-gap environments, simplified onboarding, agent-assisted registration, transparent fees, and low-data interfaces are likely more relevant than feature expansion. In mobile-led transitions, interoperability between mobile money, bank accounts, and merchant systems is critical. In mature systems, innovation can shift toward savings automation, responsible digital credit, open-finance services, and consumer-controlled data portability. Such differentiation is more efficient than deploying a uniform "digital-first" strategy across structurally different markets.



(a) Ten largest positive and negative conversion gaps **(b)** Principal-component map of four innovation archetypes

Figure 5. Country diagnostics beyond average inclusion levels.

5.3 Implications for regulators and public institutions

Public authorities can use the benchmark to distinguish infrastructure deficits from conversion deficits. Where both connectivity and use are low, basic access remains a priority. Where connectivity is high but predicted use exceeds observed use, institutional frictions deserve scrutiny: know-your-customer procedures, documentation requirements, merchant fees, cash-out dependence, consumer redress, network reliability, and confidence in providers.

The positive predictive contribution of reported fraud exposure underscores a measurement challenge. As adoption rises, recorded fraud attempts may initially rise because more users are exposed and reporting mechanisms improve. Regulators should therefore avoid treating raw incident prevalence as a simple failure measure. A stronger dashboard combines attempted fraud, realized losses, transaction volume, reporting rates, reimbursement outcomes, and time to resolution. Safety policy should seek lower harm per transaction, not silence in complaint or survey data.

Regional holdouts further show that a global model cannot replace local institutional knowledge. South Asia's systematic negative gaps indicate that regional context contains omitted factors. Benchmarking should initiate investigation rather than close it. Local payment architecture, government-payment design, informal finance, gender norms, identity systems, and cash preferences remain essential to interpretation.

6. BOUNDARY CONDITIONS AND FUTURE RESEARCH

Four limitations define the appropriate use of the results. First, the analysis is cross-sectional. The conversion gap is a relative diagnostic, not evidence that changing a predictor will cause a corresponding change in payment use. Longitudinal estimation across future Findex waves could distinguish persistent institutional efficiency from temporary shocks.

Second, the complete-case requirement reduces the 2024 low- and middle-income sample to 74 economies. The connectivity tracker was not administered identically everywhere, and omitted countries may differ systematically. Multiple imputation was not used because the missingness structure reflects survey-module availability rather than plausibly random item nonresponse.

Third, economy-level averages conceal within-country inequality. Gender, age, income, education, rurality, disability, and displacement can generate sharply different conversion processes inside the same national system. A multilevel extension using microdata would permit individual prediction nested within institutional environments.

Fourth, important supply-side conditions are absent: payment-rail interoperability, merchant density, transaction pricing, digital identity coverage, service outages, agent liquidity, competition, and legal protection. Adding these measures could turn the conversion gap into a richer operational scorecard. Future work should also validate whether positive gaps predict subsequent resilience, formal saving, business creation, or inclusive growth rather than digital activity alone.

7. CONCLUSION

Digital finance advances when enabling conditions are converted into routine, trusted use. The evidence from 74 developing economies shows that this conversion can be modeled with substantial out-of-sample accuracy, yet it varies enough to make infrastructure-only rankings misleading. A regularized linear model explained 88.1% of out-of-fold variation in digital-payment participation, with an average absolute error of 5.10 percentage points. Account ownership was the principal signal, but connectivity, capability constraints, and risk exposure added diagnostic information.

The conversion-gap index and four archetypes offer a practical alternative to uniform inclusion targets. They reveal where observable capacity is outperforming expectations, where latent capacity remains underused, and which combination of access, trust, capability, and resilience should be addressed first. For financial institutions and regulators, the most productive question is no longer simply whether people are connected or banked. It is whether the surrounding system enables them to turn those assets into safe, useful, and repeated financial activity.

DATA AND REPRODUCIBILITY

The analysis package contains the country-level data file, variable dictionary, executable Python script, all intermediate result tables, and the PNG source for every figure panel. Running `python code/analysis.py` from the package root reproduces the analytical sample, model comparison, out-of-fold predictions, diagnostics, and figures.

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