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WHEN THE INDUS MEETS THE ALGORITHM FINTECH, MARKETING, CLIMATE RISK INSURANCE, AND THE DESIGN OF FINANCIAL PROTECTION IN PAKISTAN

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ABSTRACT

Pakistan can now move money across the country in seconds. It has yet to learn how to insure the livelihoods that its floods sweep away. This paper asks why climate-exposed households and small firms remain poorly protected even as the country's digital payment infrastructure matures, and argues that the answer lies where three disciplines meet but seldom confer. Finance determines how climate risk is priced, funded, pooled and transferred. FinTech lowers the cost of information, payment, distribution and claims. Financial services marketing determines whether a customer understands the product, trusts the provider, sees its value and stays. From these strands the paper builds a conceptual model of two reinforcing frictions. The affordability trap arises when the price of risk is held below cost without an explicit, budgeted subsidy, so that supply thins. The familiarity trap arises when automated underwriting treats a short financial history as weak evidence of quality, so that the undocumented are screened out. Between them runs a marketing adoption bridge: trust, perceived usefulness, ease of use, salience and clarity of communication decide whether protection that exists is bought, kept and claimed, and therefore whether the records on which future underwriting depends are ever created. The paper formalises each mechanism, derives four testable hypotheses and specifies a Pakistan-focused empirical programme combining district risk exposure, insurer and lender records, payment data, customer surveys and randomised message experiments. It reports no causal estimates. Its contribution is a framework that makes finance, FinTech and marketing jointly observable. The policy corollary is an architecture of transparent risk pricing, explicit premium support, parametric

cover where suitable, interoperable digital distribution, plain-language communication and auditable algorithms.
Keywords: FinTech; financial services marketing; climate risk insurance; digital financial inclusion; consumer trust; parametric insurance; algorithmic underwriting
JEL classification: G22, G23, G28, M31, O16, Q54

1. Introduction

In 1580 the Mughal revenue administration, guided by Akbar's revenue minister Raja Todar Mal, settled on a method that a modern actuary would recognise. The state's cash demand on each crop was fixed from the recorded yields and prices of the preceding ten years (Habib, 1999). The past was made to price the future. Four and a half centuries later, Pakistan's insurers and lenders are attempting the same feat with satellites and smartphones, and they are meeting the same limitation. A record can price only what it has recorded.

The floods of 2022 wrote the latest entries in that record. Some 33 million people were affected, more than 1,730 lost their lives and more than 8 million were displaced. The Post-Disaster Needs Assessment put damages above USD 14.9 billion, economic losses at about USD 15.2 billion and the cost of rehabilitation and reconstruction at no less than USD 16.3 billion, with Sindh bearing close to 70 per cent of the damage and loss (Government of Pakistan et al., 2022; World Bank, 2022b). Very little of this was insured. The World Bank records insurance penetration of a mere 0.81 per cent of GDP in 2022, one of the lowest ratios in the world, and notes that insured losses amounted to only 1 per cent of the total losses caused by the floods of 2010 (World Bank, 2024). A country that does not insure its risks still pays for them. It simply pays after the event: from the budget, from donors, from its creditors and, most expensively, from the savings and assets of its poorest households.

The customary response is to ask why insurance is so expensive. A more useful question is what a price conceals when it is not allowed to reflect risk. Mr Micawber, who taught the young David Copperfield that happiness and misery lie on either side of a balanced budget, would have recognised the arithmetic at once. If a premium is held below expected loss plus the cost of capital and administration, the shortfall does not disappear. It is carried by other policyholders, by the insurer's balance sheet, by the public purse or, in the end, by the household that discovers after the flood that no policy was ever written. A subsidy can be entirely defensible. What is harder to defend is a subsidy that is neither budgeted nor evaluated: an off-balance-sheet liability dressed as consumer protection.

The second question is digital, and here Pakistan has more to show. Raast, the State Bank of Pakistan's instant payment system, opened for bulk payments in January 2021, added person-to-person transfers in February 2022 and was extended to person-to-merchant payments in December 2023 ("Digital Payments," 2023; State Bank of Pakistan, 2021; World Bank, 2022a). In the year to June 2024 it processed 496.1 million transactions worth about PKR 11.6 trillion, against 147.2 million transactions worth about PKR 3.1 trillion a year earlier, while the share of retail payments made digitally rose from 76 to 84 per cent by volume (State Bank of Pakistan, 2024a, 2024b). The rails, in short, are no longer the principal excuse for the absence of cheap and timely financial protection.

But a payment rail is not a market. A market needs a product, a customer, a reason to believe the promise and a mechanism for keeping it. This is where marketing enters the

argument, and it enters by the front door. Randomised experiments with rainfall insurance in rural India found demand to be sensitive to price, yet also constrained by a lack of trust, by liquidity and by limited salience (Cole et al., 2013). In Pakistan, a survey of 275 potential users found customer trust to matter more than the other factors examined in explaining the intention to use FinTech (Zhao et al., 2024). Inclusion is partly a problem of distribution. It is also, and perhaps chiefly, a problem of persuasion, and of relationships that survive a bad season.

This paper therefore brings three perspectives to one table. Finance asks how risk should be priced, funded and transferred. FinTech asks how information and payment technology can lower the cost of intermediation. Marketing asks how trust, perceived usefulness, communication, service and relationship quality turn an available product into an adopted one. The purpose is not to paste three labels onto one paper. It is to show that the three mechanisms interact, and that their interaction explains outcomes that none of them explains alone.

The paper makes four contributions. First, it formalises an affordability trap in which a suppressed price of risk weakens supply. Second, it formalises a familiarity trap in which data-driven screening favours the already documented. Third, it places a marketing adoption bridge between the availability of a product and the protection a household actually enjoys, and shows that the bridge also manufactures the records on which future underwriting depends. Fourth, it translates the combined framework into four hypotheses and a research design specific to Pakistan. The paper is conceptual. It does not pretend to have estimated what has not yet been estimated.

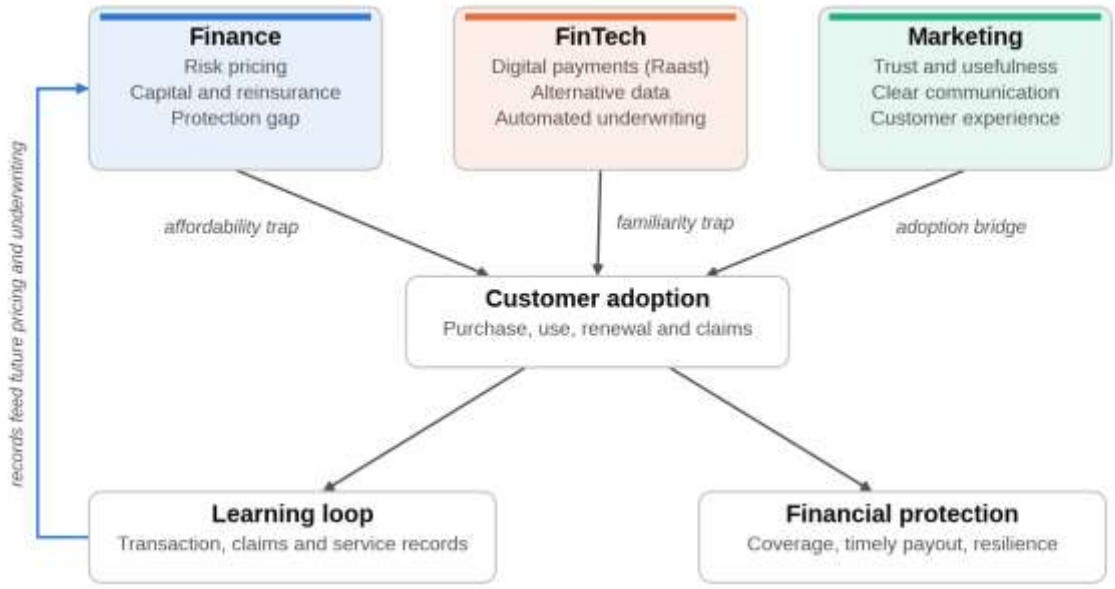
Its claims are deliberately modest. It does not argue that every price intervention is harmful, that every algorithm is biased, or that clever marketing can dissolve structural poverty. It argues something narrower and, one hopes, more useful: if FinTech is to widen financial protection, the design of price, data, product communication and customer trust must be settled together rather than in separate ministries, departments and journals.

Conceptual contribution at a glance

The paper treats affordability, data familiarity and customer adoption as interacting constraints rather than independent barriers. The result is a single finance, FinTech and marketing mechanism that can be tested with administrative outcomes and customer experiments (Figure 1).

Figure 1

Integrated Finance, FinTech and Marketing Framework



Note. Arrows show the direction of influence. The blue path is the learning loop: records created by adoption inform later pricing and underwriting. Source: authors' conceptualisation.

2. Approach and Scope

The article follows the *model* template for conceptual research described by Jaakkola (2020). It identifies constructs from established theory, specifies the relationships between them, and states those relationships in a form that can be refuted. Three bodies of theory are used, each for a declared purpose. Insurance economics supplies the pricing and capital mechanisms (Clarke & Dercon, 2016; Froot, 2001; Koijen & Yogo, 2015). The FinTech and credit literature supplies the information mechanism (Berg et al., 2020; Fuster et al., 2022). Relationship marketing and technology acceptance theory supply the adoption mechanism (Davis, 1989; Morgan & Hunt, 1994).

Contextual evidence is drawn from official and multilateral sources, namely the national Post-Disaster Needs Assessment, World Bank diagnostics, State Bank of Pakistan payment statistics and the Global Findex database, supplemented by peer-reviewed studies of Pakistani consumers. The statistics used are those published on or before 25 March 2025, the date of this manuscript. Figures that refer to a fiscal year are labelled as such; Pakistan's fiscal year runs from July to June. The mathematical statements in Section 5 are stylised. They make the logic of the argument explicit; they are not calibrated estimates.

3. Literature Review

3.1 Climate insurance, pricing and the protection gap

The economics of catastrophe insurance has long accepted that extreme, correlated risks are awkward to pool and expensive to finance. Froot (2001) showed that insurers bought relatively little reinsurance against the largest catastrophes, that premiums were high relative to expected losses, particularly after major events, and that the most persuasive explanations lay in capital market imperfections and the market power of traditional reinsurers. Koijen and

Yogo (2015) demonstrated how financial frictions can push insurers to price policies far from their actuarial value when balance sheets are under strain. Clarke and Dercon (2016) carried the argument into development policy: money arranged before a disaster, under rules agreed in advance, does more good than generosity improvised afterwards.

For households the difficulty is not only whether a premium is actuarially fair. Liquidity, trust, salience and familiarity all shape demand (Cole et al., 2013). Index insurance adds a further complication. Because it pays on a measured trigger rather than on assessed loss, it carries basis risk, and Clarke (2016) shows that rational demand for such a contract is non-monotonic in risk aversion and falls to zero for an infinitely risk-averse buyer, a sobering result for products designed for the most vulnerable. The social fabric matters as well. Mobarak and Rosenzweig (2013) find that informal risk sharing within caste networks complements index insurance where basis risk is high, and that farmers offered cover shift towards higher-yielding but less drought-tolerant rice varieties. Protection changes behaviour as well as outcomes.

Pakistan makes the protection gap unusually visible. Insurance penetration of 0.81 per cent of GDP in 2022 compares with an emerging-market average of 3.3 per cent and an advanced-market average of around 9.5 per cent in 2023 (Swiss Re Institute, 2024; World Bank, 2024). The World Bank also observes that the domestic industry has shown limited appetite for climate risk. The gap is therefore more than a ratio. It marks a transfer mechanism that was absent when a correlated shock arrived, so that the state, donors, households and firms carried the loss through fiscal spending, aid, debt and the quiet sale of assets.

3.2 FinTech and digital financial inclusion

The FinTech literature has emphasised cheaper intermediation, new sources of information and wider access. Arner et al. (2016) trace the long evolution of financial technology and argue that its post-crisis phase marks a new paradigm. Philippon (2016) frames the opportunity as a chance to reduce the stubbornly high unit cost of financial intermediation. Berg et al. (2020) show that the digital footprints left by online shoppers are at least as informative about default as a credit bureau score. Fuster et al. (2022) find that machine learning can sharpen credit decisions while distributing the gains unevenly across groups of borrowers. Buchak et al. (2018) show how technology and regulatory differences together reshaped the structure of mortgage lending in the United States.

Evidence from Kenya shows what is at stake. Access to M-PESA, the mobile money service, lifted an estimated 194,000 households, about 2 per cent of all Kenyan households, out of poverty, with larger effects for households headed by women (Suri & Jack, 2016). Ozili (2018) cautions, however, that the benefits of digital finance for users, providers and governments come with unresolved problems that must be addressed if it is to deliver inclusion in developing and emerging economies. Infrastructure is necessary. It is not sufficient.

For Pakistan the infrastructure story matters because payment systems can connect product design to delivery. The State Bank built Raast to offer digital, efficient and cost-effective payments, presented it as a catalyst for small businesses and individuals, and set out to make its services free to end users (State Bank of Pakistan, 2021; World Bank, 2022a). Yet infrastructure does not produce inclusion by itself. A system can reduce the cost of a transaction while leaving the customer uncertain about the product, the provider and the outcome.

3.3 Financial services marketing: trust, usefulness and relationship

Marketing enters financial services at the moment an abstract promise becomes a customer's decision. Insurance is an unusually difficult product to sell because its central benefit is contingent: its value is realised in a future state of distress that the buyer would rather not imagine. The customer must therefore trust both the provider and the contract. Morgan and Hunt's (1994) commitment-trust theory places trust at the centre of durable exchange relationships. In finance, trust is not decorative brand equity. It is part of the economic mechanism that persuades a customer to surrender money today for a promise that may not be tested for years.

Technology acceptance theory offers a second bridge. Davis (1989) identifies perceived usefulness and perceived ease of use as fundamental determinants of whether a technology is adopted. Applied to FinTech-enabled insurance, the implication is sobering. A technically superior product can fail if the customer cannot see how it improves the household's position, or cannot work the interface without help. A parametric policy that pays within days is financially valuable, yet its adoption depends on whether customers understand the trigger, trust the data source, know the payout and believe that the digital channel will function when roads and power lines do not.

Evidence from Pakistan reinforces the point. Zhao et al. (2024), applying structural equation modelling to 275 survey responses from potential users, conclude that customer trust in FinTech matters more than the other factors they examine and that it raises the intention to use FinTech. A qualitative study of account holders who do not use their digital accounts identifies dependency, illiteracy, lack of trust, cost, lack of access to financial services and financial instability as the principal barriers (Nizam & Rashidi, 2024). Inclusion therefore requires strategies for acquiring and keeping customers, not merely for connecting them.

3.4 The missing junction

The three literatures are neighbours who rarely visit. Insurance research concentrates on pricing, capital and risk transfer; FinTech research on technology, information and access; marketing research on trust, adoption, communication and relationships. What is missing is the junction: the mechanism by which a digitally delivered financial product becomes trusted protection, and the way in which the records created by that adoption later change underwriting.

The bridge proposed here is therefore circular rather than linear. Pricing shapes whether a product is viable. Viability shapes distribution. Distribution and customer experience shape adoption. Adoption generates transaction and claims records. Records shape underwriting, and underwriting changes the price and availability of the next generation of products. Marketing acts at several points on this circle, because it governs salience, perceived usefulness, trust, communication and the continuity of the relationship.

4. The Pakistani Setting

4.1 The flood and the protection gap

The 2022 floods are the natural starting point because they exposed, with unusual brutality, the difference between economic loss and insured loss. The heaviest damage fell on housing (USD 5.6 billion), agriculture and livestock (USD 3.7 billion) and transport and communications (USD 3.3 billion). The assessment projected that the national poverty rate could rise by 3.7 to

4.0 percentage points, pushing between 8.4 and 9.1 million more people below the poverty line (Government of Pakistan et al., 2022; World Bank, 2022b). Against losses of that order, a penetration ratio below 1 per cent of GDP is less an insurance statistic than a macro-financial vulnerability.

Pakistan is not without instruments. The Crop Loan Insurance Scheme, introduced by the State Bank in 2008, is the country's largest crop insurance programme. At the time of the World Bank's 2018 feasibility study, premiums for small borrowers were fully subsidised up to a maximum rate of 2.0 per cent of the sum insured, and cover was triggered only when a disaster had been declared by the authorities and crop losses exceeded 50 per cent of normal production (World Bank, 2018). The study's verdict is instructive: the scheme protects lending institutions against default more than it protects the farmer's own investment in the crop. A capped rate, a declared-disaster trigger and a lender-centred design are each defensible. Together they show how a protection product can exist on paper while leaving much of the household's exposure in place.

A household without insurance has few good options after a shock. It can borrow, sell productive assets, cut consumption, wait for transfers or lean on relatives. Ghalib, who drank on credit in the confident belief that his penury would one day bear colour, captured the optimism with which such borrowing is often undertaken; the arithmetic seldom obliges. Each response carries a future cost. A small firm faces a similar sequence. A flood that destroys inventory becomes a working-capital crisis, then a credit problem, then an employment problem. Financial protection therefore has a multiplier that reaches well beyond the insurance contract itself.

4.2 The digital rails

Pakistan's payment infrastructure has changed quickly. Raast began with bulk payments in 2021 and added person-to-person transfers, with a mobile number serving as the payment address, in 2022 (State Bank of Pakistan, 2021; World Bank, 2022a). In December 2023 the State Bank launched the person-to-merchant service, supporting payment by QR code, Raast alias, IBAN and request-to-pay, and instructed regulated entities not to charge customers for such payments ("Digital Payments," 2023). In November 2024 it went further, directing regulated entities to enable existing account holders that provide in-store or online shopping services to accept Raast payments by 31 March 2025, and to enable new merchants at the point of onboarding ("SBP Pushes for Raast P2M Integration," 2024). The direction matters because it treats digital acceptance as part of ordinary commercial life rather than as a specialist service.

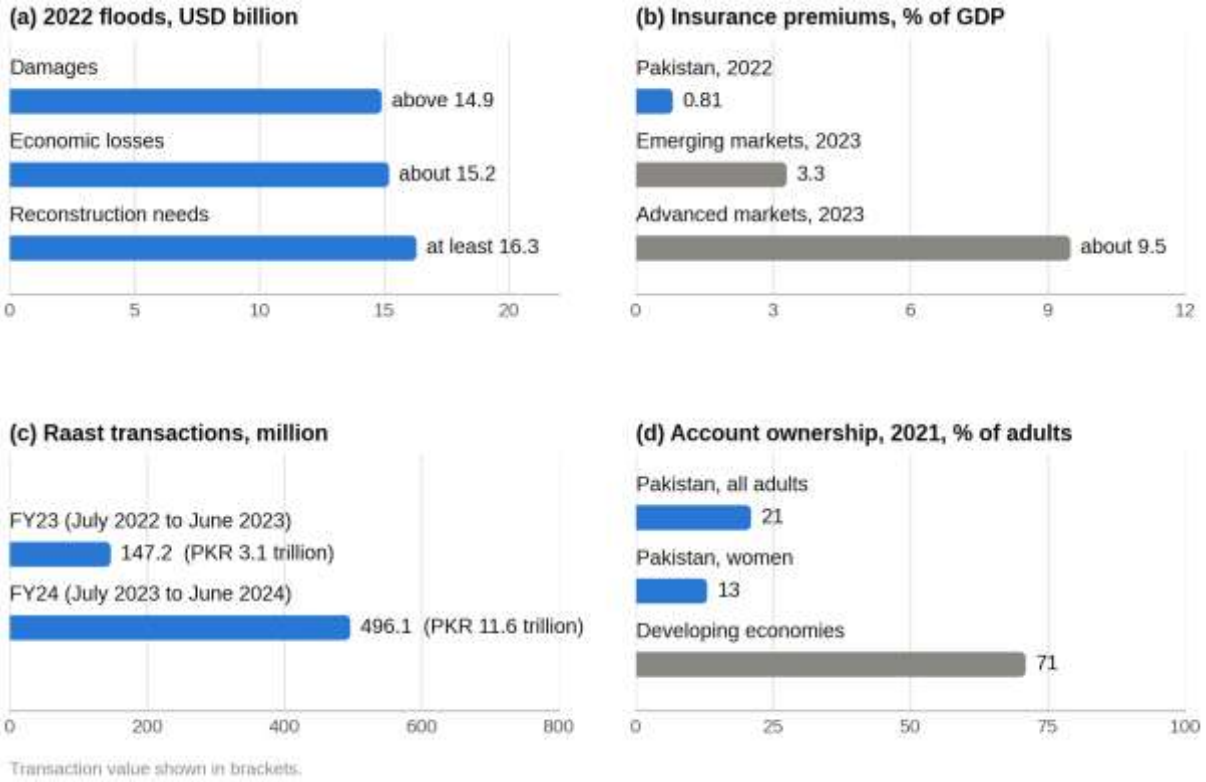
The volumes have grown accordingly. Raast handled 496.1 million transactions worth PKR 11.6 trillion in FY24, more than three times the 147.2 million transactions worth PKR 3.1 trillion recorded in FY23 (State Bank of Pakistan, 2024a). Across all retail payments, volumes rose from 4.7 billion to 6.4 billion transactions and the digital share from 76 to 84 per cent (State Bank of Pakistan, 2024b). None of this proves that insurance can be digitised at scale. It does show that the distribution infrastructure on which such a market would depend has become substantial (Figure 2).

The distinction is important. A payment system can deliver a payout in seconds without persuading anyone to buy protection in advance. The marketing problem remains. Customers

must understand the product before the flood, trust the provider during it, and recognise the payout afterwards as a promise kept rather than a windfall.

Figure 2

Pakistan's Protection Gap and Digital Rails in Numbers



Note. Panel (a): Government of Pakistan et al. (2022) and World Bank (2022b). Panel (b): World Bank (2024) for Pakistan, 2022; Swiss Re Institute (2024) for market averages, 2023; the years differ and the comparison is indicative. Panel (c): State Bank of Pakistan (2024a); fiscal years end on 30 June. Panel (d): Demirgüç-Kunt et al. (2022); account ownership at a financial institution or through a mobile money service.

4.3 The customer

The relevant customer is not a statistical average. The customer may be a smallholder, a woman running an enterprise from her home, a shopkeeper with irregular takings or a small manufacturer in a flood-prone district. Such customers can be economically active while remaining thinly documented. In 2021 only 21 per cent of Pakistani adults, and 13 per cent of women, had an account with a financial institution or a mobile money service, against an average of 71 per cent across developing economies (Demirgüç-Kunt et al., 2022). The consequence is a double invisibility: demand for insurance is hard to observe, and risk is hard for automated systems to price.

Marketing research suggests that the answer cannot be a single national advertising campaign. Segmentation matters because the barriers differ. A first-time digital user may need assurance about security and a plain account of the payout. A farmer may care most about the transparency of the trigger and the size of the basis risk. A merchant may prize liquidity and speed. A woman whose account is linked to her household may respond to

different signals of trust from those that move a male business owner. Product design and communication are therefore complements, not substitutes.

5. Twin Frictions and One Adoption Bridge

5.1 The affordability trap

Consider an insurer offering cover in district d. Per unit of sum insured, it faces an expected loss μ_d, a charge κ_d for the risk capital that the exposure requires, and an administrative and distribution cost a_d. The break-even premium is

$$P_d^* = \mu_d + \kappa_d + a_d \tag{1}$$

Suppose that regulation, a scheme rule or administrative pressure fixes the permitted premium at $\bar{P}_d$. Wherever $\bar{P}_d$ falls short of P^*_d, each unit of cover carries a shortfall

$$G_d = max(0,\, P_d^* - \bar{P}_d) \tag{2}$$

The shortfall G_d is an implicit subsidy, and it does not vanish. It is absorbed by cross-subsidy from other lines, by thinner coverage, by stricter underwriting, by slower claims or, ultimately, by withdrawal. An explicit subsidy $s_d = G_d$, budgeted and paid by the state, would restore viability without falsifying the price signal. The difference between the two arrangements is the difference between a provision entered in the accounts and a liability kept off them.

This is the affordability trap. It is tempting to describe a low premium as a benefit to consumers. That description is incomplete if the low premium also shrinks supply or makes the contract unreliable. A visible subsidy solves the affordability problem and remains open to evaluation. An invisible one cannot be evaluated, because neither the customer nor the policymaker can see what it costs. Panel (a) of Figure 3 draws the trap in stylised form.

5.2 The familiarity trap

Now consider an automated lender or underwriter estimating the quality q_i of applicant i from the n_i observations in the applicant's formal record. Let the estimate $\hat{q}_i$ have standard error $\sigma/\sqrt{n_i}$, and suppose the institution approves an application only when a cautious lower bound on quality clears a threshold τ:

$$\hat{q}_i - z\frac{\sigma}{\sqrt{n_i}} \geq \tau \tag{3}$$

where z reflects the institution's caution. For an applicant whose true quality is q_i, the probability of approval, π_i, is then

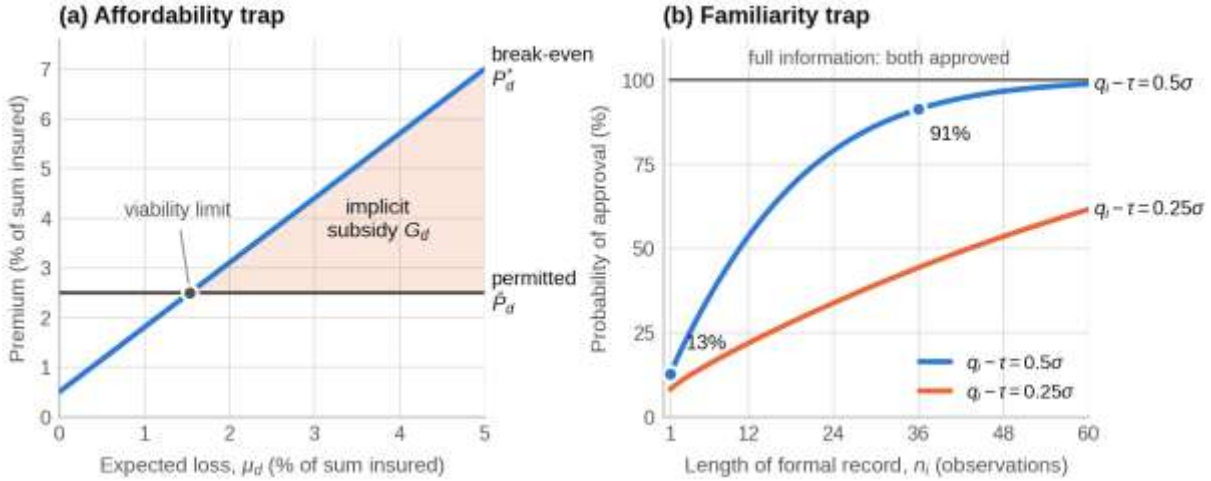
$$\pi_i = \Phi\left(\frac{(q_i - \tau)\sqrt{n_i}}{\sigma} - z\right) \tag{4}$$

where Φ is the standard normal distribution function. For any creditworthy applicant, with q_i above τ, the probability rises with n_i. Two applicants of identical true quality are treated differently because one has the longer record. With the illustrative values in Figure 3, an applicant whose quality lies half a standard deviation above the threshold has about a 13 per cent chance of approval with one observation and about 91 per cent with thirty-six.

The mechanism need not be malicious. A model trained on the past learns from what the past recorded. The difficulty arises when the recorded economy is systematically narrower than the real one. Thin-file farmers, informal enterprises, new borrowers and first-time digital customers are unfamiliar to the model, and caution converts unfamiliarity into refusal. The result can be efficient prediction inside the documented pool and inefficient exclusion outside it, a pattern consistent with the uneven distribution of gains documented by Fuster et al. (2022).

Figure 3

The Twin Frictions in Stylised Form



Note. Panel (a) plots Equations 1 and 2 with illustrative values $\kappa_d = 0.3\mu_d$, $\alpha_d = 0.5$ per cent of the sum insured and a permitted rate of 2.5 per cent; the shaded area is the implicit subsidy G_d. Panel (b) plots Equation 4 with $\sigma = 1$, $\tau = 0$ and $z = 1.645$. Neither panel is calibrated to Pakistani data or to any existing scheme. Source: authors' calculations.

5.3 The marketing bridge

Between the availability of a product and the protection a household enjoys lies adoption. Let A_i denote the probability that customer *i* buys, keeps and, when entitled, successfully claims on a protection product. The paper represents adoption as

$$A_i = f(P_i, U_i, E_i, T_i, S_i, C_i) \tag{5}$$

where P_i is the perceived price burden, U_i perceived usefulness, E_i perceived ease of use, T_i trust, S_i the salience of the risk and of the product, and C_i the quality and continuity of communication. The function f is decreasing in P_i and increasing in each of the other arguments. The expression states directions, not magnitudes.

The bridge matters because the cheapest product can fail if it is distrusted, while the simplest can fail if its value is not perceived. Conversely, transparent triggers, credible claims procedures, familiar distribution channels, plain language and visible institutional guarantees can raise adoption without altering the actuarial risk at all. Here relationship marketing and technology acceptance theory become directly relevant to FinTech-enabled insurance (Davis, 1989; Morgan & Hunt, 1994).

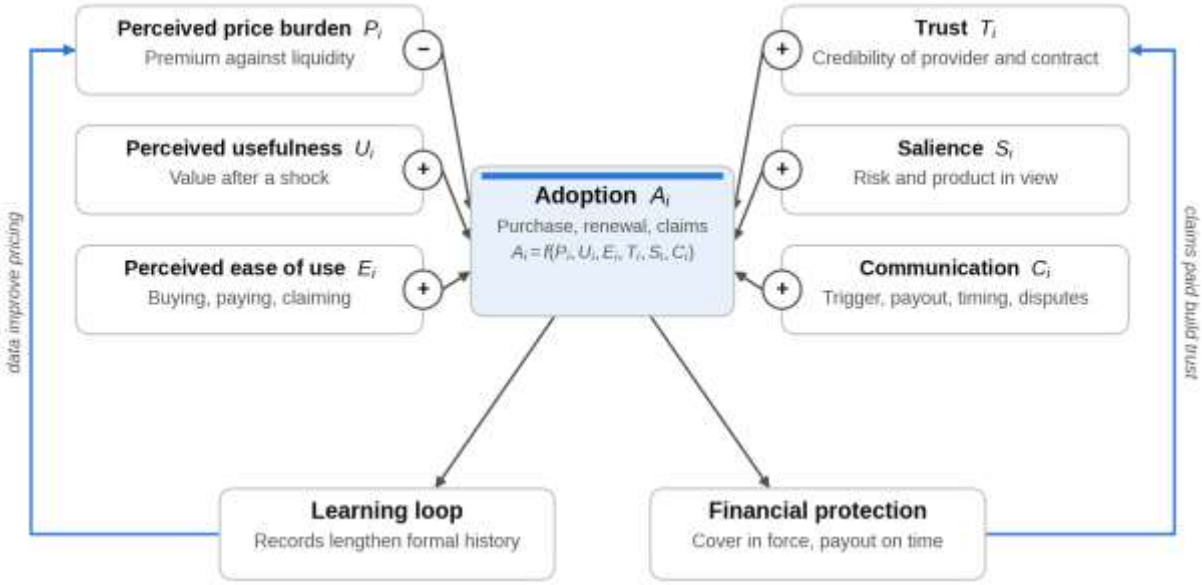
The bridge also carries traffic in the other direction. When a customer buys a policy, pays a premium, makes a claim and receives a payout, the transaction leaves a record, and adoption thus lengthens the very history on which Equation 4 depends. In its simplest form, with $h_{d,t}$ the average length of formal history in district *d* at time *t*,

$$h_{d,t+1} = h_{d,t} + A_{d,t} \cdot 1[\bar{P}_d + s_d \geq P_d^*] \tag{6}$$

where the indicator equals one when the permitted premium plus any explicit subsidy covers the break-even premium, so that a product is supplied at all. History accumulates only where a product is both supplied and adopted. Marketing therefore does not stand outside the financial information system. A good customer relationship is also a source of evidence (Figure 4).

Figure 4

The Marketing Adoption Bridge and Its Learning Loop



Note. Signs give the hypothesised direction of each effect in Equation 5. The blue paths are feedback: records improve later pricing (Equation 6), and claims paid on time reinforce trust. Source: authors' conceptualisation, drawing on Davis (1989) and Morgan and Hunt (1994).

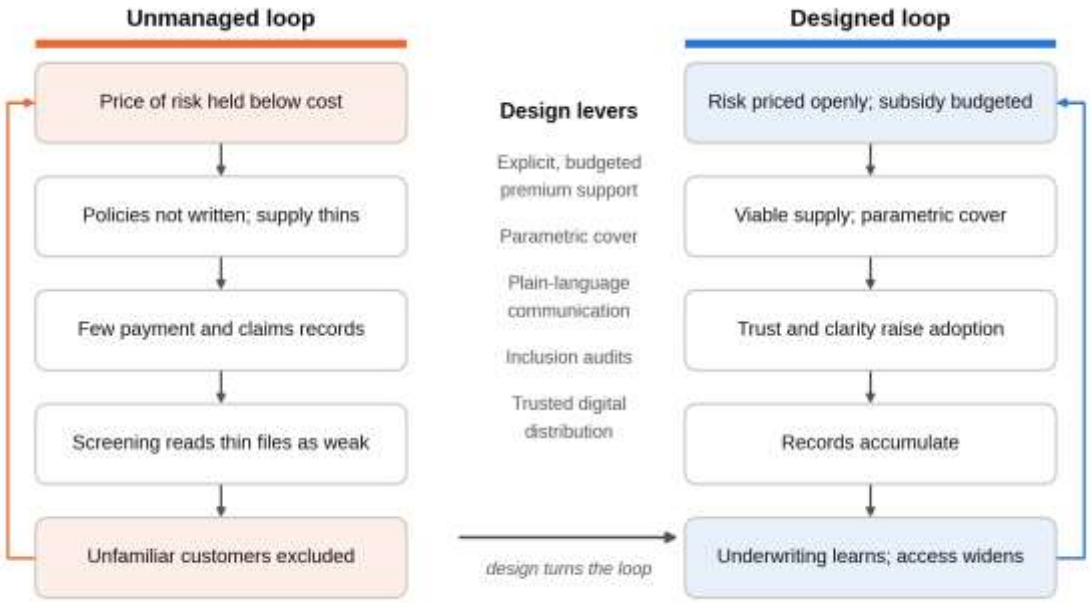
5.4 Why the traps compound

The central proposition is sequential. If prices are suppressed, policies may not be written. If policies are not written, claims histories do not accumulate. If histories do not accumulate, the data available to future automated systems remain thin. If those systems then read thin data as low quality, the districts that were poorly served in the first period are screened out in the second. A price distortion becomes a data distortion, and the data distortion then passes, to the untrained eye, for a fact about the customers.

Marketing can reinforce this cycle or break it. Poor communication depresses adoption even where a sound product exists, producing fewer observations and weaker underwriting later. Trust-building, simple explanations, reliable claims communication and transparent service raise adoption, and with it the volume and quality of the records that formal protection generates. The same loop can turn in either direction, as Figure 5 shows. Which way it turns is a matter of design.

Figure 5

How the Twin Traps Compound, and How Design Can Reverse the Loop



Note. Each column reads from top to bottom and returns to its start. Source: authors' conceptualisation.

5.5 Hypotheses

The framework yields four hypotheses. Table 1 sets out working definitions and candidate measures for each construct.

- **H1.** Districts and product lines in which permitted premiums fall furthest below modelled break-even premiums (the largest G_d) will show thinner private cover and greater insurer retreat after major floods, holding physical exposure constant.
- **H2.** As underwriting becomes more automated, approved or insured customers will become more concentrated among applicants with longer formal histories, while first-time, rural, women-led and thin-file applicants will face lower approval or offer rates, conditional on observable risk.
- **H3.** Trust, perceived usefulness, perceived ease of use, salience and the clarity of claims communication will each predict the adoption and retention of FinTech-enabled climate protection, over and above price.
- **H4.** The exclusion described in H2 will be strongest in districts where the premium suppression described in H1 is most severe, and weaker where trusted digital distribution and active customer support raise adoption and so generate new records.

Table 1

Constructs, Working Definitions and Candidate Measures

Construct	Working definition	Candidate measure	Anchor in the literature
Premium suppression, G_d	Gap between the break-even and the permitted premium in district *d*	Modelled $\mu_d + \kappa_d + \alpha_d$ less the permitted rate	Froot (2001); World Bank (2018)
Record length, n_i and $h_{d,t}$	Depth of an applicant's or a district's formal financial history	Months of account, payment or credit history	Berg et al. (2020); Fuster et al. (2022)
Perceived price burden, P_i	Premium relative to household liquidity at the time of purchase	Premium as a share of monthly income; reported difficulty of payment	Cole et al. (2013)
Perceived usefulness, U_i	Belief that the product improves the household's position after a shock	Multi-item scale adapted to insurance	Davis (1989)
Perceived ease of use, E_i	Belief that buying, paying and claiming require little effort	Multi-item scale; time to complete a trial purchase	Davis (1989)
Trust, T_i	Confidence in the reliability and integrity of the provider and the contract	Multi-item trust scale	Morgan and Hunt (1994); Zhao et al. (2024)
Salience, S_i	Prominence of flood risk and of the product at the moment of decision	Unprompted recall of trigger and payout; exposure to reminders	Cole et al. (2013)
Communication quality, C_i	Clarity and continuity of information on trigger, payout, timing and disputes	Comprehension test score; time taken to resolve complaints	Nizam and Rashidi (2024)
Adoption, A_i	Purchase, renewal and successful claiming	Policy, renewal and claims records	Davis (1989); Morgan and Hunt (1994)

Note. Scales should be translated into Urdu and regional languages and validated before use.
Source: authors' compilation.

6. Empirical Strategy and Data

Because this article builds theory rather than reporting results, the designs below are specified before any estimation. The programme aims to separate the effects of price from those of trust and communication, and to distinguish predictive performance from inclusion. Primary outcomes should be pre-registered, treatment and comparison groups defined *ex*

ante, confidence intervals reported and robustness checked against alternative measures of digital history and climate exposure. Figure 6 and Table 2 summarise the four designs.

The first design (D-I) tests H1 by constructing a district-level premium-suppression index from modelled hazard, permitted premiums, subsidies and observed coverage, in effect an empirical estimate of G_d. The outcome is private insurance coverage before and after major floods. District and year fixed effects, province-by-year shocks, matching on hazard, comparisons between neighbouring districts and placebo tests on pre-flood years can remove the most obvious sources of confounding.

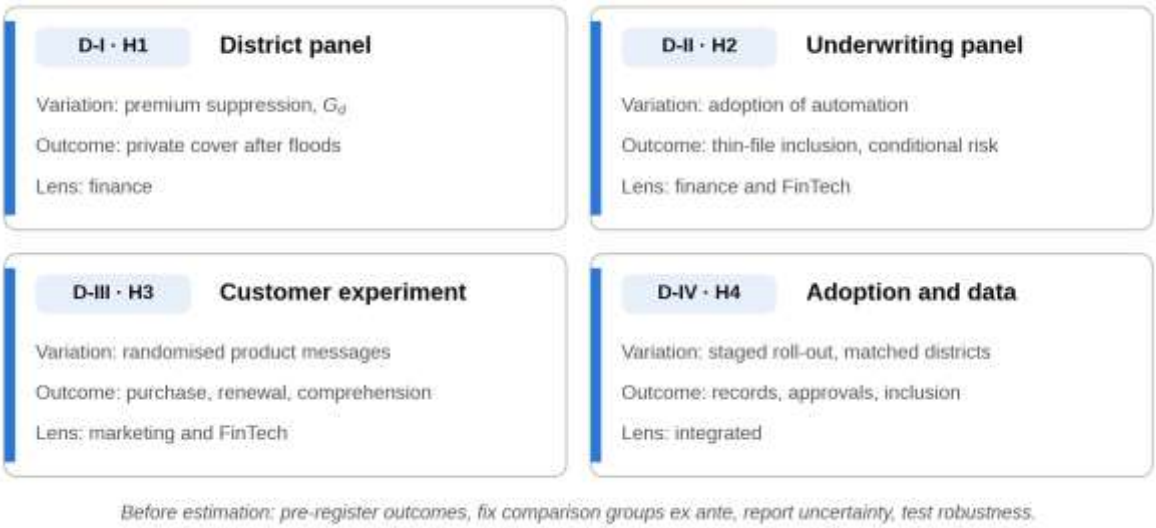
The second design (D-II) tests H2 using lender and insurer portfolios observed before and after material increases in automated underwriting. The outcome can be a thin-file inclusion index combining first-time applicants, rural applicants, women-led enterprises and applicants without prior formal credit. The analysis must separate model performance from customer composition. A lower approval rate for thin-file applicants is not, by itself, evidence of algorithmic bias if their realised risk is materially different. The relevant comparison is conditional risk and subsequent repayment or claims experience.

The third design (D-III) tests H3 through a customer-level survey experiment or field experiment. Respondents are randomly assigned one of several descriptions of the same parametric product: actuarial information alone, a message on the speed of payout, a message on trust and institutional assurance, or a combination. Outcomes include willingness to buy, willingness to pay, comprehension of the trigger and confidence in the claims process. Because stated intention can differ from behaviour, the design should observe actual purchase and renewal wherever possible. The contribution of marketing is then measured rather than asserted.

The fourth design (D-IV) tests H4 by linking adoption and underwriting outcomes geographically. Districts with greater use of digital payments and stronger customer-service engagement can be compared with otherwise similar districts; a stronger design would exploit a staged roll-out or randomly assigned communication campaigns. Any use of Raast or other transaction-level data would require consent where applicable, anonymisation, sound data governance and regulatory approval.

Figure 6

Empirical Research Architecture for H1 to H4



Note. D-I to D-IV denote the four research designs described in Section 6 and Table 2. Source: authors' conceptualisation.

Table 2

Empirical Designs, Identification and Data

Design	Hypothesis	Identification	Key variables and sources
D-I: District panel	H1	District and year fixed effects; hazard matching; neighbouring-district comparisons; pre-flood placebo tests	SECP insurance returns; provincial scheme and subsidy records; NDMA loss data; satellite flood extent
D-II: Underwriting panel	H2	Difference-in-differences around the adoption of automation; borrower-level matching; pre-trend tests	SBP supervisory data; credit bureau records; lender and insurer application and approval logs
D-III: Customer experiment	H3	Randomised product-message treatments with behavioural follow-up	Purchase and renewal; willingness to pay; comprehension; trust; perceived usefulness and ease of use
D-IV: Adoption and data	H4	Staged roll-out or matched district comparison; geographic interaction terms	Digital payment adoption; claims histories; customer-support contacts; inclusion indicators

Note. SECP = Securities and Exchange Commission of Pakistan; NDMA = National Disaster Management Authority; SBP = State Bank of Pakistan. Access to supervisory and transaction-level data is subject to the approvals described in the Declarations.

7. FinTech and Marketing Design for Climate Protection

7.1 Product: parametric protection

A parametric product can cut the cost of claims adjustment by paying when an objectively measured trigger is reached, rather than requiring a loss assessment for every household. River-gauge or rainfall thresholds, satellite observations or other independently verifiable measures can serve as the trigger. The product must nevertheless explain basis risk without euphemism (Clarke, 2016). A customer who receives nothing after a damaging local flood, because the index did not cross its threshold, will not experience the product as an innovation. The customer will experience it as a broken promise, unless the possibility was understood in advance.

7.2 Price: actuarial truth with explicit support

The recommendation is not to make insurance cheap by hiding its cost. It is to separate the price of risk from the policy decision to make that price affordable. Premiums should reflect modelled risk as far as is practical, while public support is targeted, budgeted and transparent. In the notation of Section 5, s_d should appear in the public accounts rather than lie buried in G_d. Policymakers can then ask the question that matters: whether the same rupee reduces vulnerability more effectively through pre-arranged insurance than through relief after the event (Clarke & Dercon, 2016).

7.3 Distribution: digital rails and human reassurance

Raast can become the payment layer for premiums and payouts, but it should not be mistaken for the customer relationship. A digital channel works best when paired with trusted intermediaries, clear communication in local languages, assisted onboarding where needed and visible routes for resolving disputes. The marketing objective is not acquisition alone. It is a confidence that survives the moment when the product is tested.

7.4 Communication: sell the promise by explaining the mechanism

Financial protection is unusually vulnerable to vague advertising. Communication should state the trigger, the payout, the timing, the exclusions, the premium and the dispute mechanism. A useful campaign would show the customer what happens before, during and after a flood. This is more demanding than conventional promotion, but it lays a firmer foundation for trust. In the language of relationship marketing, the provider is not merely making a claim; it is setting the terms of a continuing relationship (Morgan & Hunt, 1994). No customer should need a glossary to discover what the *bima* (the policy) will pay, and when.

7.5 Algorithmic accountability: market the audit, not the mystery

Digital providers should publish inclusion metrics alongside conventional performance metrics, such as the share of first-time customers, rural customers, women-led businesses and thin-file applicants who receive offers. Where appropriate, a human review channel should remain open. Such transparency serves marketing as much as regulation. An institution that can explain how it treats unfamiliar customers has a stronger claim on their trust than one that presents an opaque score as an oracle. Auditors, after all, are not trusted because they are mysterious.

8. Sustainable Development Goals and Policy Architecture

The proposed architecture has four parts. First, introduce or expand parametric climate protection in the most exposed districts, with premiums set on transparent risk models and affordability addressed through explicit public support. Second, establish reinsurance or risk-pooling arrangements so that correlated catastrophe losses do not overwhelm domestic capacity. Third, require algorithmic inclusion audits together with explanation and review at the level of the individual customer. Fourth, create anonymised public datasets that widen the information available for future risk and credit modelling, subject to privacy and consent safeguards. Table 3 maps these elements to the Sustainable Development Goals (United Nations, 2015).

Table 3

Mapping the Policy Architecture to the Sustainable Development Goals

Goal	Connection	Illustrative indicator
Goal 1: No poverty	Fast payouts reduce distress borrowing and asset sales after floods	Share of affected policyholders receiving a valid payout within 14 days
Goal 5: Gender equality	Digital accounts and inclusion audits can track women's participation in protection and finance	Women's share of policyholders and of approved first-time borrowers
Goal 8: Decent work and economic growth	Insurance and credit protect working capital and productive assets	Survival rate of insured versus uninsured microenterprises
Goal 9: Industry, innovation and infrastructure	Interoperable payments, digital claims and audited models form financial infrastructure	Number of districts with live digital protection and audited underwriting
Goal 13: Climate action	Pre-arranged finance turns adaptation into a funded mechanism	Share of modelled flood loss covered by pre-arranged instruments
Goal 17: Partnerships for the goals	Reinsurers, government, FinTech firms, insurers and data institutions share the tail risk and the infrastructure	Reinsured share of catastrophe exposure; number of active institutional partners

Note. Goal titles follow United Nations (2015). Indicators are proposed by the authors and are not official SDG indicators.

9. Discussion

The framework carries an uncomfortable implication for both disciplines. Finance cannot treat marketing as a cosmetic layer applied to a finished product. If trust and comprehension determine adoption, they also determine how much data the institution will later possess, and marketing therefore sits inside the production of financial information. Equally, marketing cannot treat finance as a back-office constraint. A beautifully communicated product that is actuarially unsustainable will, in time, disappoint the very customer it persuaded.

The framework also changes how FinTech should be judged. The right question is not whether a model predicts default better than a loan officer. It is whether the system improves allocation while extending access to viable customers who were previously invisible. Accuracy within the historical pool can coexist with exclusion outside it. A proper performance dashboard should therefore report inclusion alongside prediction.

Public policy faces a similar choice. A government can secure an attractive premium today by suppressing price, and discover later that supply has quietly withered. Alternatively, it can allow prices to tell the truth and subsidise those who cannot afford them. The second

arrangement is politically more conspicuous, but conspicuousness is a virtue where public money is concerned. A subsidy that can be measured can also be improved, or withdrawn.

Finally, the framework gives customer experience a place in financial resilience. Claims settlement, payout speed, complaint resolution and communication after an adverse event are not peripheral service metrics. They are the moments at which trust is confirmed or destroyed. One badly handled claim can deter far more than one customer, because word travels quickly in a village and more quickly still by telephone. That is why marketing research and financial research should not be kept in separate compartments.

10. Limitations and Research Agenda

The paper has limitations that should be stated plainly. First, it is conceptual, and its hypotheses remain to be tested in Pakistan. Second, evidence from other countries cannot be assumed to travel without modification; Pakistan's insurance regulation, informal economy, provincial policy variation and digital infrastructure have their own character. Third, the proposed data may be difficult to obtain, since insurance and lending records are commercially and regulatorily sensitive and payment data require strong privacy safeguards. Fourth, parametric insurance carries basis risk and can fail as a product if customers do not understand the index. Fifth, marketing interventions may change stated intention without changing purchase or retention, which is why field experiments and administrative outcomes are preferable to surveys of intention alone. Sixth, the formal statements in Section 5 are deliberately stylised; richer models would allow for adverse selection, moral hazard and learning by lenders.

A useful research programme would proceed in stages: measuring the protection gap and the distribution of existing insurance and digital finance; testing the determinants of trust, perceived usefulness and adoption; evaluating alternative product and communication designs experimentally; examining whether adoption improves the quality of later underwriting data; and, finally, assessing whether the combined system reduces household and firm losses after climate shocks.

The agenda suits finance and marketing scholars alike because the dependent variables are shared. Finance can study risk pricing, capital, reinsurance and loss absorption. Marketing can study trust, segmentation, adoption, communication, retention and customer experience. FinTech supplies the infrastructure that joins the two, and the data through which their interaction can at last be observed.

11. Conclusion

Floods will return. That is the one forecast for which Pakistan needs no further model. The harder question is whether finance will return with them, and whether the products built before the next flood will be trusted enough to be used.

Pakistan now possesses an increasingly capable digital payment system. It also has one of the lowest rates of insurance penetration in the world. The opportunity lies in the space between these two facts. Financial protection can be priced more truthfully, subsidised more openly, distributed more cheaply, explained more clearly and paid more quickly. None of these tasks belongs to finance, FinTech or marketing alone.

The central proposition of this paper is therefore simple. A financial system learns from what it records. A market records what customers buy. Customers buy what they understand and trust. If policy suppresses the price of risk until protection disappears, there is no

transaction from which a future system can learn; if an algorithm then mistakes the absence of a record for the absence of quality, exclusion becomes self-perpetuating. The remedy is to design price, product, distribution, communication and data as parts of one system.

Sindh has had a Lloyd of its own since January 1932, when the barrage at Sukkur opened under that name. It was built to govern water, not risk. The Indus will go on keeping its ledger of floods. The question for the republic is whether its financial institutions will learn to keep a ledger of their own, and whether they will make room in it for the people who have so far been left out.

Declarations

Author contributions. [To be completed by the authors using the CRediT taxonomy, for example: First Author: conceptualisation, formal analysis, methodology, writing (original draft). Second Author: conceptualisation, methodology, writing (review and editing). Both authors must approve the final manuscript and accept responsibility for its integrity.]

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Data availability. No new data were created or analysed for this article. Figure 2 reproduces published statistics from the sources listed in its note. Figures 1 and 3 to 6 are the authors' own illustrations; Figure 3 is generated from Equations 1, 2 and 4 with the stated illustrative parameters.

Ethics. Not applicable to this conceptual article. Any customer experiment, sandbox audit or use of transaction-level data proposed in Section 6 would require institutional ethical review, informed consent where applicable, anonymisation and regulatory approval.

Use of generative AI and AI-assisted tools. [State which tools were used in preparing this manuscript and for what purpose, in the form required by the target journal.]

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