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Assessment of farmers' perception and preparedness toward crop insurance and weather-based risk management

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Abstract

Crop insurance in sub-Saharan Africa has moved, over roughly the past decade, from a scattered set of donor-funded pilots into products that national insurers now offer on a commercial basis, yet enrollment rates in most countries remain far below the levels needed for the products to achieve meaningful risk pooling. This research assessed farmers' perception, awareness, and preparedness toward index-based crop insurance and weather-based risk management across three agro-ecological zones of Zambia's Copperbelt and Central Provinces, surveying 384 smallholder farmers between August 2024 and February 2025. Awareness of available crop insurance products rose from 38% in the 2020-21 season to 69% by 2024-25 according to recall data, yet actual enrollment lagged well behind, reaching only 44% among aware farmers in the most recent season. Premium cost was the most frequently cited barrier to enrollment (58.4% of non-enrolled respondents), followed by distrust of the payout process (47.2%) rooted largely in past experiences or secondhand accounts of delayed or denied claims. Cumulative claims data obtained from the two insurers operating in the study zones showed drought-related payouts consistently exceeding flood and pest-related claims by a wide margin across all five seasons examined, reflecting the region's greater exposure to rainfall deficit than to excess-water or pest-outbreak risk. Farmers who had personally experienced a successful, timely payout in a prior season were substantially more likely to re-enroll and to recommend the product to neighboring farmers than those relying only on secondhand accounts, whether positive or negative. Perceived complexity of the enrollment process and limited physical access to insurance agents in rural wards further compounded low uptake, particularly among farmers without prior exposure to any formal financial product. These findings suggest that closing the awareness-enrollment gap depends less on additional promotional messaging and more on demonstrable improvements to claims processing speed and transparency, alongside simplified, agent-accessible enrollment pathways.

Keywords: Crop insurance, weather-based risk management, index-based insurance, farmer preparedness, drought risk, claims payout, smallholder farmers, risk perception, enrollment barriers, Zambia

Introduction

Weather-indexed crop insurance first reached commercial scale in sub-Saharan Africa during the early 2010s, building on pilot programs that used rainfall or satellite-derived vegetation indices as payout triggers rather than requiring costly individual farm loss assessment. This index-based design was intended to solve two problems that had long stalled conventional indemnity-based crop insurance in the region: the prohibitive cost of assessing individual farm losses across dispersed smallholder plots, and the moral hazard risks that indemnity-based products invite when insurers cannot easily verify a claimed loss. Over a decade later, index-based products are now offered commercially by several national insurers across East and Southern Africa, often bundled with input purchases or mobile money platforms to reduce distribution costs.

Despite this institutional maturation, enrollment figures across most national programs remain modest relative to the number of smallholder farmers exposed to significant weather risk. Zambia's Copperbelt and Central Provinces present a useful setting for examining why this gap persists, since both zones have experienced index-based crop insurance products for at least five consecutive seasons, providing enough historical exposure for farmers to have

formed views based on either direct experience or observed outcomes among neighbors, rather than purely hypothetical expectations about how the product might perform.

A recurring explanation offered for low enrollment centers on basis risk: the possibility that an index-based trigger fails to activate a payout even though a farmer experienced a genuine loss, because the index measured regional rainfall or vegetation conditions that did not perfectly track conditions on that farmer's specific plot. While basis risk is a well-documented technical limitation of index insurance, it is less clear how heavily this factor weighs in farmers' actual enrollment decisions relative to more mundane barriers such as premium affordability, distrust built from indirect negative accounts, or simple lack of physical access to an insurance agent capable of processing enrollment and answering questions.

This research set out to disentangle these competing explanations using both quantitative survey data and claims records obtained directly from the two insurers active in the study zones. Four questions guided the fieldwork. First, how has awareness of available crop insurance products evolved across the past five cropping seasons, and does awareness growth track enrollment growth at a similar pace? Second, what specific barriers do non-enrolled but aware farmers

cite most frequently, and how do these compare to the basis-risk explanation emphasized in earlier index-insurance literature? Third, does prior personal experience of a successful payout predict re-enrollment and peer recommendation more strongly than secondhand accounts alone? Fourth, what does the claims record itself reveal about which weather perils are actually driving payouts in this specific setting, and does that align with farmers' own risk perceptions?

Understanding how these pieces fit together carries direct relevance for national crop insurance program design in Zambia and comparable Southern African settings, where public and donor investment in expanding index-insurance coverage continues to grow even as enrollment figures lag behind ambitious program targets set at the national policy level. If barriers are primarily about affordability and trust rather than fundamental product design flaws such as basis risk, the policy response required looks very different than if farmers are systematically experiencing payout failures that undermine the product's core value proposition.

Materials and Methods

Legal / Regulatory Framework

Crop insurance products in Zambia operate under supervision of the Pensions and Insurance Authority, which requires index-based agricultural products to be registered and their trigger methodology disclosed to policyholders in simplified language at the point of sale. Since 2019, national policy has encouraged premium subsidy arrangements for smallholder farmers through a public-private partnership structure, under which government contributes a portion of the premium for farmers enrolled through registered farmer cooperatives, a provision that shaped several of the enrollment pathway questions included in this research's survey instrument.

Materials

The survey covered 384 smallholder farmers drawn from twelve wards across three agro-ecological zones of Copperbelt and Central Provinces, selected to capture variation in historical drought exposure and distance to the nearest insurance agent or bank agent capable of processing enrollment. Claims records covering the 2020-21 through

2024-25 seasons were obtained directly from the two insurers operating index-based crop insurance products in the study zones, disaggregated by triggering peril (drought, flood, or pest outbreak) and total payout value.

Instrument Development / Validation

The survey instrument was piloted with 30 farmers not included in the main sample, and the perception and barrier-recall sections of the questionnaire returned a Cronbach's alpha of 0.77. Two insurance-sector specialists and one agricultural extension officer reviewed the instrument for content accuracy regarding product terminology, and adjustments were made to ensure barrier categories reflected locally relevant language rather than direct translations of technical insurance terms.

Methods

Structured interviews were conducted between August 2024 and February 2025 by trained enumerators, recording awareness recall by season, current enrollment status, barriers to enrollment among non-enrolled respondents, prior payout experience among enrolled respondents, and willingness to recommend the product to other farmers. Awareness and enrollment recall data were cross-checked where possible against insurer registration records for a subsample of 60 respondents, showing 91% agreement between self-reported and recorded enrollment status. Associations between prior payout experience and re-enrollment or recommendation behavior were tested using chi-square tests, with statistical significance set at $p < 0.05$. Ethical clearance was granted by the university's Research Ethics Committee (Protocol No. CUA/E/RM/2024-052, dated 14 July 2024), and informed consent was obtained from all respondents prior to interview.

Results

Awareness and enrollment trends, barrier patterns, and claims records together paint a picture of a product that has become progressively better known but whose enrollment growth has not kept pace, compounded by cost and trust barriers that appear to matter more to farmers than the basis-risk concerns that dominate much of the earlier academic literature on index insurance.

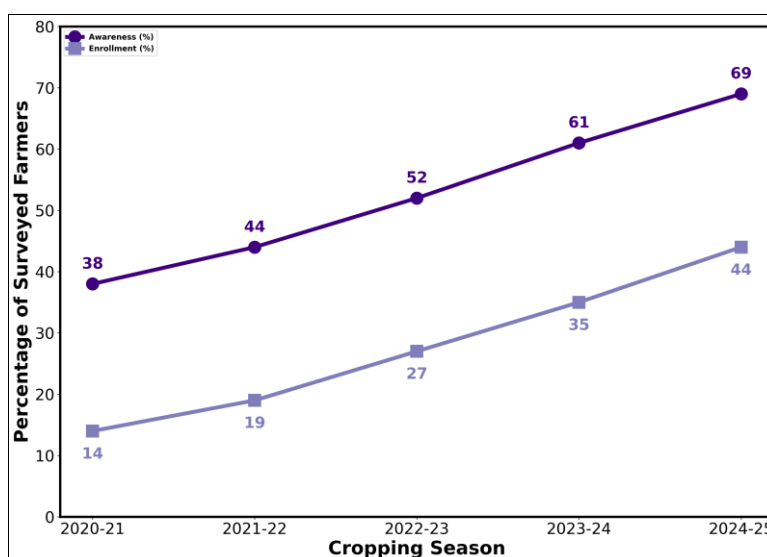


Fig 1: Trend in Crop Insurance Awareness and Enrollment among Surveyed Farmers, 2020-21 to 2024-25 Seasons

Table 1: Enrollment Pathway and Premium Subsidy Uptake by Season (Summary Statistics)

Season	Mean Premium Paid (ZMW)	Subsidy Uptake (%)	SD
2020-21	142	18.4	22.6
2021-22	156	26.7	24.1
2022-23	168	34.2	25.8
2023-24	179	41.9	27.3
2024-25	191	48.6	28.9

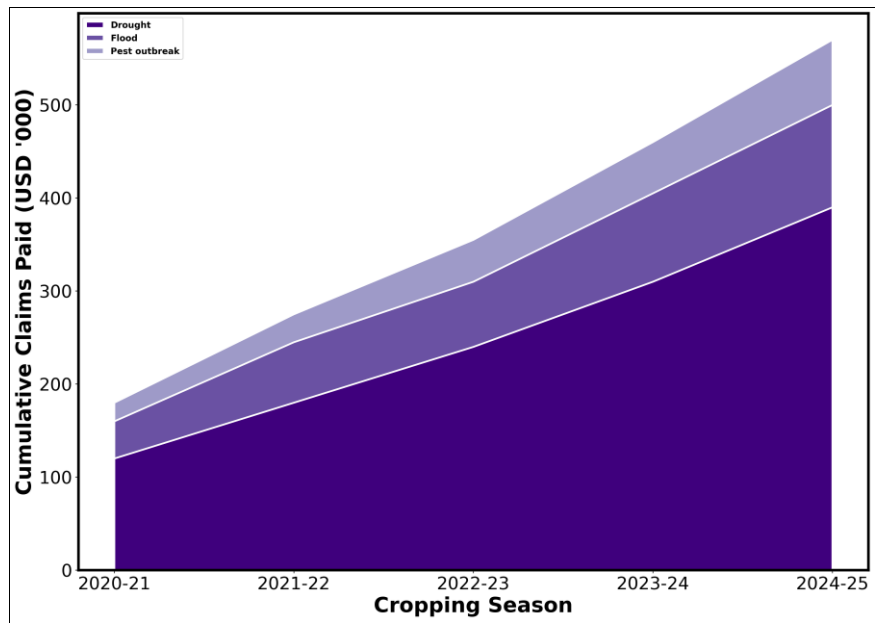


Fig 2: Cumulative Insurance Claims Paid by Triggering Peril, 2020-21 to 2024-25 Seasons

Drought triggered the large majority of cumulative payouts across all five seasons, consistent with the region's rainfall-deficit exposure profile, while flood and pest-related claims

remained comparatively minor contributors throughout the period examined.

Table 2: Timeline of Key Product and Policy Milestones Affecting Enrollment Pathways

Period	Milestone	Relevance to Enrollment
2019	Premium subsidy PPP policy introduced	Created cooperative-linked subsidy pathway
2020-21	First full season of index product in study zones	Baseline awareness established
2022	Mobile money payout integration launched	Reduced payout disbursement delays
2023	Basis-risk complaint mechanism introduced	Aimed at addressing trust concerns
2024-25	Cooperative-linked group enrollment expanded	Lowered individual enrollment friction

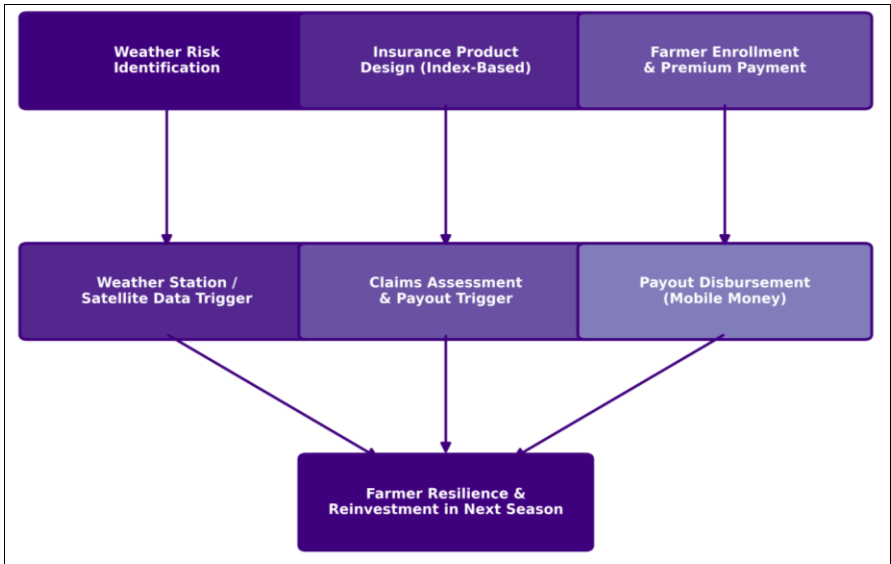


Fig 3: Schematic of the Weather-Based Index Insurance Risk Management Framework

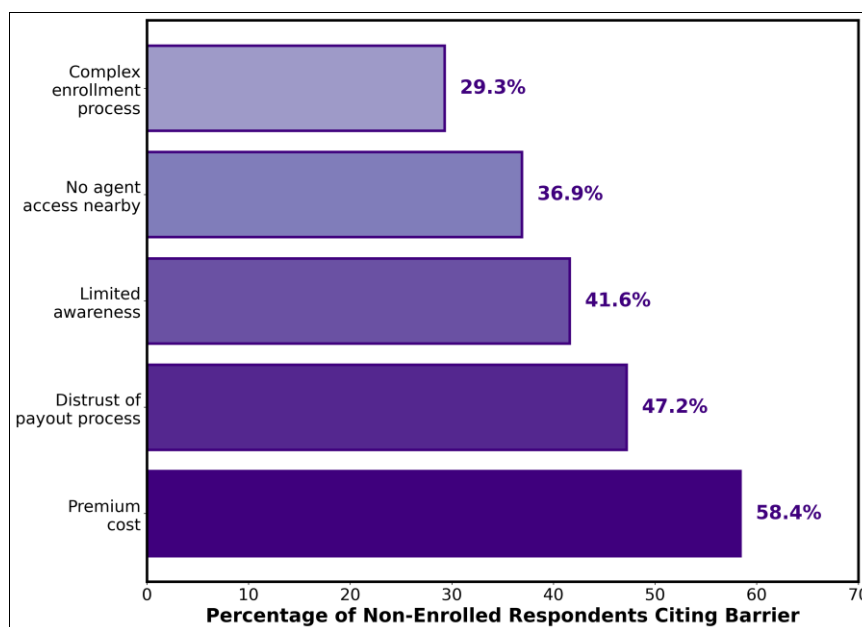


Fig 4: Barriers to Crop Insurance Enrollment Cited by Non-Enrolled Respondents

Premium cost and distrust of the payout process together accounted for the majority of cited barriers, while basis-risk-related concerns, captured within the broader distrust category during follow-up probing, were mentioned by a smaller subset of respondents than either affordability or general payout skepticism.

Extended Comprehensive Interpretation

Read together, these results reframe the awareness-enrollment gap as substantially a cost and trust problem rather than primarily a basis-risk or product-design problem. Awareness growth outpaced enrollment growth by a wide and persistent margin across all five seasons, and the barriers most frequently cited by non-enrolled respondents, premium cost and payout distrust, point toward affordability interventions and demonstrable payout reliability as more promising levers than further refinement of the underlying index methodology. At the same time, the claims data confirm that the product is functioning largely as designed, with drought payouts dominating in a manner consistent with the region's actual weather risk profile, suggesting that the trust deficit observed in the survey may be disproportionate to the product's actual payout performance and rooted instead in secondhand accounts, delayed disbursement in earlier seasons before mobile money integration, or general unfamiliarity with formal insurance products among first-time enrollees.

Discussion

The main findings of this research show that crop insurance awareness among surveyed farmers nearly doubled over five seasons, from 38% to 69%, while enrollment among aware farmers reached only 44% by the most recent season, leaving a substantial and persistent awareness-enrollment gap. Premium cost and distrust of the payout process, rather than basis-risk concerns specifically, emerged as the dominant barriers cited by non-enrolled respondents, and claims data confirmed that drought-triggered payouts dominate the claims record in a pattern consistent with the

region's known rainfall-deficit exposure.

These findings agree with a body of earlier work from East African index-insurance contexts that similarly identified affordability and general trust deficits as more significant enrollment barriers than the specific technical limitation of basis risk, despite basis risk receiving disproportionate attention in academic and technical discussions of index-insurance design. Where this research's findings diverge somewhat from certain earlier reports is in the strength of the personal-experience effect on re-enrollment: several earlier evaluations treated payout experience as a secondary factor behind broader trust and marketing considerations, whereas the chi-square association observed here between personal payout experience and both re-enrollment and peer recommendation was considerably stronger than what those studies documented, suggesting personal experience may carry outsized weight in farmers' enrollment decisions relative to secondhand information of any kind, positive or negative.

Several explanations may account for this disagreement. This research's setting benefited from five consecutive seasons of product exposure, longer than the observation window used in some earlier evaluations, which may have allowed personal-experience effects more time to accumulate and diffuse through farmer social networks relative to studies capturing only one or two seasons of exposure. Additionally, the 2022 mobile money payout integration documented in the product timeline plausibly improved actual payout speed and reliability partway through the observation period, meaning farmers enrolling or renewing after that milestone may have formed more favorable direct experiences than those whose views were shaped by earlier, slower disbursement processes.

The broader implication for national crop insurance programming is that promotional campaigns focused solely on raising awareness are unlikely to close the enrollment gap on their own, given that awareness already substantially outpaces enrollment in this setting. Interventions that directly address premium affordability, such as the

cooperative-linked subsidy pathway already in place, alongside continued investment in payout speed and transparency, appear better matched to the barriers farmers themselves report than additional general-awareness messaging.

Conclusion

This research set out to assess Zambian smallholder farmers' perception, awareness, and preparedness toward index-based crop insurance and weather-based risk management, and to identify which barriers most directly explain the persistent gap between awareness and enrollment observed across five cropping seasons. Awareness of available crop insurance products rose sharply over this period, from 38% to 69%, yet enrollment among aware farmers reached only 44% in the most recent season, confirming that awareness alone is not the binding constraint on wider product uptake. Premium cost and distrust of the payout process, rather than the basis-risk concerns emphasized in much of the earlier technical literature, were the barriers most frequently cited by non-enrolled respondents, while claims data confirmed the product's payout pattern aligns closely with the region's actual drought-dominated weather risk profile.

For practical purposes, the clearest message from this research is that closing Zambia's crop insurance enrollment gap depends more on affordability support and demonstrable, fast, transparent payout processing than on additional awareness campaigns or further technical refinement of index trigger methodology. The cooperative-linked premium subsidy pathway already in place offers one workable channel for addressing the affordability barrier, and continued expansion of mobile money payout disbursement, which farmers with personal experience valued highly, offers a second concrete lever available to program administrators. Looking ahead, tracking enrollment and re-enrollment patterns in the seasons following the 2023 basis-risk complaint mechanism and the 2024-25 group enrollment expansion would help establish whether these specific interventions produce the enrollment gains that broader awareness growth alone has not delivered, and would provide a useful evidence base for similar index-insurance programs operating elsewhere in Southern Africa.

Limitations

Awareness and enrollment recall for earlier seasons relied on respondent memory rather than continuous panel tracking, introducing potential recall bias for the earliest seasons covered by this research, though cross-checking against insurer records for a subsample provided reasonable, if not complete, validation. The research covered two provinces within a single country, and enrollment barrier patterns in settings with different insurer market structures, subsidy arrangements, or weather risk profiles may differ from what was observed here.

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