

Implementation Processes and Mediating Factors in Agricultural Support Programmes: Evidence from Zambia's Farmer Input Support Programme in Kawimbe Ward, Mbala District

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ABSTRACT: *Agricultural input subsidy programmes remain central to food security policy in sub-Saharan Africa, yet persistent implementation failures undermine their effectiveness. Zambia's Farmer Input Support Programme (FISP), a major intervention reaching over one million smallholder households, has faced chronic challenges in timely delivery, equitable targeting, and digital access through its e-voucher system. Understanding these implementation barriers is critical for designing more effective support, particularly as Zambia considers reforms to agricultural support. This article examines the implementation processes of FISP in a remote rural context and identifies the institutional, socio-economic, and environmental factors that are associated with programme implementation outcomes.*

Methods: *The study employed a sequential explanatory mixed-methods design. Quantitative data were collected from 300 households (150 FISP beneficiaries and 150 non-beneficiaries) in Kawimbe ward, Mbala District, Northern Province, using structured questionnaires measuring e-voucher functionality, input timeliness, accessibility, targeting fairness, and mediating factors. Qualitative data were gathered through 15 key informant interviews with agricultural officers, agro-dealers, traditional leaders, and cooperative leaders, and 12 focus group discussions stratified by gender and beneficiary status. Quantitative data were analysed using descriptive statistics, bivariate tests, and binary logistic regression. Qualitative data were analysed using thematic analysis. Food security was measured using HFIAS, HDDS, and MAHFP scales. Mixed-methods integration was achieved through a joint display and narrative weaving.*

Results: *Implementation failures were pervasive. Only 34.0% of beneficiaries received inputs on time, with mean delays of 3.4 weeks. E-voucher functionality challenges affected 52.0% of beneficiaries, and agro-dealer stock-outs affected 54.7%. Female-headed households comprised only 14.0% of beneficiaries despite constituting 22% of farming households. Distance to agro-dealer (AOR=1.15 per km, $p=0.003$) and female-headed household status (AOR=2.84, $p=0.006$) were significantly associated with late delivery, while cooperative membership was protective (AOR=0.42, $p=0.014$). Food security analysis revealed that beneficiaries had significantly lower HFIAS scores than non-beneficiaries ($B=-2.13$, $p=0.002$), but the effect was attenuated for female-headed households and those in remote zones. Mediation analysis showed that input timeliness, gender of household head, distance to agro-dealer, and cooperative membership partially mediated the association between FISP participation and food security. Thematic analysis revealed five major themes: "The Digital Entitlement Gap," "The Proximity Penalty," "Gendered Exclusion," "Elite Capture and Political Interference," and "The Timeliness-Yield Connection."*

Conclusion: *Implementation failures in FISP reflect systemic transfer entitlement failures that disproportionately affect remote and female-headed households. These findings provide evidence for designing future agricultural support programmes with decentralised logistics, multiple delivery channels, gender-sensitive targeting, mobile distribution points, and strengthened community oversight. Addressing these mediating factors is essential for ensuring that agricultural support programmes achieve their intended food security outcomes in remote rural contexts.*

KEYWORDS: *Farmer Input Support Programme, e-voucher, Zambia, food security, programme implementation, smallholder agriculture*

1. Introduction

Agricultural input subsidy programmes have been a cornerstone of food security policy across sub-Saharan Africa for decades, with the aim of increasing smallholder productivity and reducing poverty (Jayne & Rashid, 2022). Zambia's Farmer Input Support Programme (FISP), established in 2002, is one of the largest and most fiscally significant such programmes on the continent, consuming between 30% and 50% of the Ministry of Agriculture's annual budget and reaching over one million households annually (Mofya-Mukuka & Hichaambwa, 2023). The programme has undergone significant transformations, most notably the introduction of an e-voucher system in 2016, designed to improve efficiency, transparency, and beneficiary choice (Zulu-Mbata et al., 2022; Mulenga & Tembo, 2024).

Despite two decades of implementation and substantial public investment, evidence on FISP's effectiveness remains contested. While national-level studies have documented increases in maize production and reductions in multidimensional poverty among beneficiaries (Ngoma et al., 2023; Manda et al., 2025), persistent implementation failures chronic delays, poor targeting, elite capture, and gender disparities continue to undermine programme effectiveness (Parliament of Zambia, 2023; Resnick, 2023). These failures are particularly acute in remote, low-market-access regions where infrastructure is poor and institutional capacity is weak (Mulenga & Tembo, 2024; Zulu-Mbata & Hichaambwa, 2023).

Critical to addressing these implementation failures is understanding the *mediating factors* that shape programme outcomes. Drawing on the Sustainable Livelihoods Framework (Scoones, 1998; DFID, 1999) and Sen's Entitlement Theory (Sen, 1981; Devereux, 2022), we conceptualise mediating factors as the household (human, financial, physical), institutional (social), and environmental (natural) capitals and vulnerability context that determine whether households can translate programme inputs into food security outcomes (Ricker-Gilbert & Mason, 2023). Gender, wealth, landholding size, education, labour availability, off-farm income, cooperative membership, extension access, agro-dealer reliability, local governance, soil quality, and climate shocks all condition programme effectiveness (Doss & Quisumbing, 2024; Zemba et al., 2025; Arslan et al., 2023).

Zambia has initiated discussions about transitioning from FISP to a broader agricultural support programme, the Comprehensive Agriculture Support Programme (CASP), which aims to broaden support to include extension, crop diversification, livestock, and agribusiness development (Ministry of Agriculture, 2025). This transition presents a critical policy window to redesign agricultural support based on evidence from two decades of FISP implementation. However, most existing evidence comes from high-potential maize-growing regions, leaving remote, high-rainfall, low-market-access contexts such as Northern Province largely unstudied (Sitko et al., 2021; Ngoma et al., 2023). This article addresses this gap by examining FISP implementation processes and mediating factors in Kawimbe, Mbala District, Northern Province.

A note on scope: This study empirically examines FISP implementation processes as experienced by beneficiary and non-beneficiary households in Kawimbe ward. It does not directly evaluate the FISP-to-CASP transition, which was not yet fully operational at the time of data collection. Rather, the study generates evidence on implementation challenges that is relevant to ongoing policy discussions about agricultural support reform in Zambia. References to CASP in this article are made as policy implications rather than as empirical findings about the transition itself.

2. Theoretical Framework

This study is guided by an integrated theoretical framework combining Sen's Entitlement Theory (Sen, 1981; Devereux, 2022), the Sustainable Livelihoods Framework (Scoones, 1998; DFID, 1999), and the Capability Approach (Sen, 1985; Nussbaum, 2011). This integration provides a comprehensive analytical lens for understanding why agricultural support programmes may fail and the conditions under which they succeed.

2.1 Sen's Entitlement Theory

Sen's Entitlement Theory provides the causal mechanism for analysing why agricultural support programmes may fail to achieve their intended outcomes. Entitlements are defined as the set of alternative commodity bundles that a person can command in a society using the totality of rights and opportunities they face (Sen, 1981). Entitlement failures are classified into four types:

1. **Transfer entitlement failure:** The state fails to deliver promised subsidies or transfers.
2. **Production entitlement failure:** Households cannot achieve adequate yields despite receiving inputs.
3. **Trade entitlement failure:** Households cannot convert surplus production into purchasing power.
4. **Utilisation entitlement failure:** Households have food but lack dietary diversity due to constraints in food preparation, storage, or intra-household distribution (Sen, 1981; Devereux, 2022).

In the context of FISP, transfer entitlement failure is the primary concern. When inputs are delivered late, vouchers cannot be redeemed due to network failures, or agro-dealers lack stock, the state has failed to deliver the promised transfer. This failure is not random but may systematically affect certain groups particularly remote and female-headed households.

2.2 The Sustainable Livelihoods Framework

The Sustainable Livelihoods Framework (SLF) provides the analytical structure for understanding *why* entitlement failures occur. Households' ability to convert programme inputs into food security outcomes depends on access to five capitals:

1. **Human capital:** Skills, knowledge, health, labour

2. **Social capital:** Networks, cooperatives, trust, community institutions
3. **Natural capital:** Land, soil, water, biodiversity
4. **Physical capital:** Infrastructure, tools, equipment, roads, market access
5. **Financial capital:** Savings, credit, income, remittances

These capitals interact with the vulnerability context shocks drought, floods, illness, trends climate change, market prices, and seasonality planting cycles, labour availability to shape household resilience and vulnerability (Scoones, 1998; Martínez-Barón et al., 2024).

2.3 The Capability Approach

The Capability Approach, also developed by Sen (1985) and elaborated by Nussbaum (2011), complements the entitlement and livelihoods frameworks by focusing on what people are able to *do* and *be* their capabilities. This approach emphasises that interventions should not merely provide resources (inputs) but should expand people's capabilities to achieve valuable functionings, such as adequate nutrition, participation in community life, and freedom from preventable morbidity.

In the context of agricultural support programmes, the Capability Approach highlights that:

Resources alone are insufficient: Access to inputs does not guarantee food security if households lack the capabilities to use them effectively.

Conversion factors matter: The ability to convert resources into outcomes depends on personal, social, and environmental conversion factors.

Agency is central: Interventions should expand people's agency their ability to act on their own behalf and make choices that matter to them.

2.4 Integrated Framework

Drawing on this integrated framework, we conceptualise the pathways from programme participation to food security as follows:

Participation → Receipt of Inputs (Transfer) → Use of Inputs (Production) → Food Security (Outcome)

This pathway is mediated by:

1. **Institutional mediating factors:** Cooperative membership, extension access, agro-dealer reliability, local governance, programme design features
2. **Household mediating factors:** Gender, wealth, landholding, education, labour, off-farm income
3. **Environmental mediating factors:** Distance to market, infrastructure, soil quality, climate shocks

Entitlement failures occur when these mediating factors prevent households from successfully navigating the pathway:

Transfer failure: Mediated by distance, institutional capacity, programme design

Production failure: Mediated by soil quality, climate, extension access

Trade failure: Mediated by market access, infrastructure

Utilisation failure: Mediated by dietary knowledge, intra-household dynamics

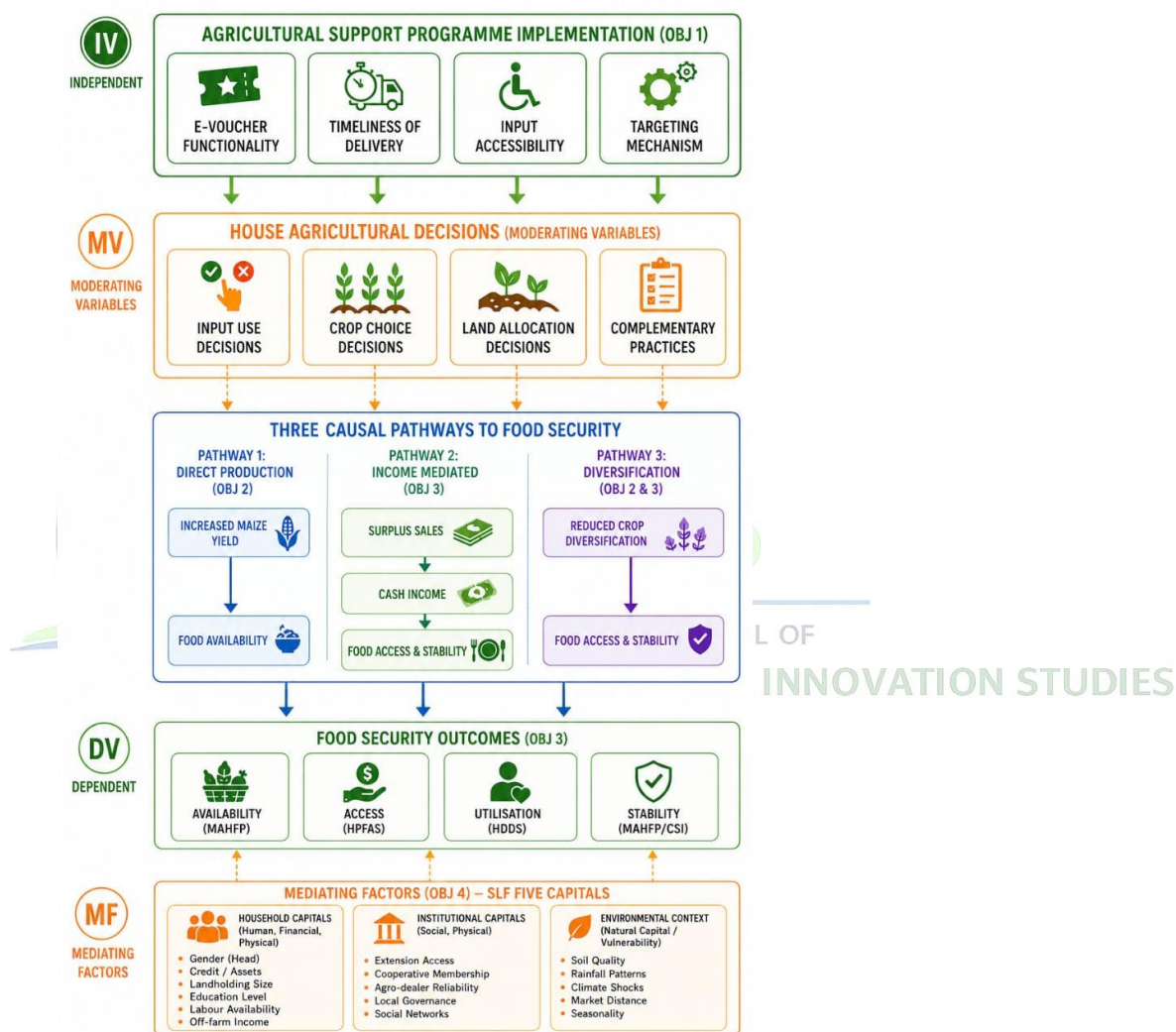


Figure 1: Conceptual Framework. Source: Author

2.5 Hypotheses

Based on this integrated framework, we test the following hypotheses:

H1: Remote villages (>10 km from agro-dealer) experience significantly higher rates of late input delivery compared to central villages (≤ 5 km).

H2: Female-headed households experience significantly higher rates of late input delivery compared to male-headed households.

H3: Households with cooperative membership experience significantly lower rates of late input delivery compared to non-members.

H4: Elite capture and political interference significantly affect targeting fairness.

H5: E-voucher functionality challenges are significantly associated with network connectivity, digital literacy, and agro-dealer liquidity.

H6: Input timeliness is significantly associated with household food security outcomes.

H7: Households receiving extension services have significantly higher food security outcomes compared to those without.

H8: Female-headed households have significantly lower food security outcomes compared to male-headed households.

H9: Input timeliness, gender of household head, distance to agro-dealer, and cooperative membership significantly mediate the relationship between FISP participation and household food security.

3. Methods

3.1 Study Design and Setting

The study employed a sequential explanatory mixed-methods design (Creswell & Plano Clark, 2018; Feters et al., 2023), with quantitative data collection followed by qualitative data collection to explain, elaborate upon, and contextualise the quantitative findings. This design was chosen because it allows for the identification of patterns in the quantitative data and the exploration of mechanisms and processes in the qualitative phase.

The study was conducted in Kawimbe ward, Mbala District, Northern Province, Zambia. Kawimbe was selected as a typical case of remote, high-rainfall, low-market-access conditions in Northern Province (Patton, 2015; Palinkas et al., 2015). The ward is characterised by high rainfall (>1000mm annually), smallholder farming systems centred on maize, beans, groundnuts, and cassava, and limited market infrastructure (Sitko et al., 2021; District Health Office, 2026). The ward has 1,527 households, with 512 registered FISP beneficiaries (ZIAMIS, 2024; DACO, 2025).

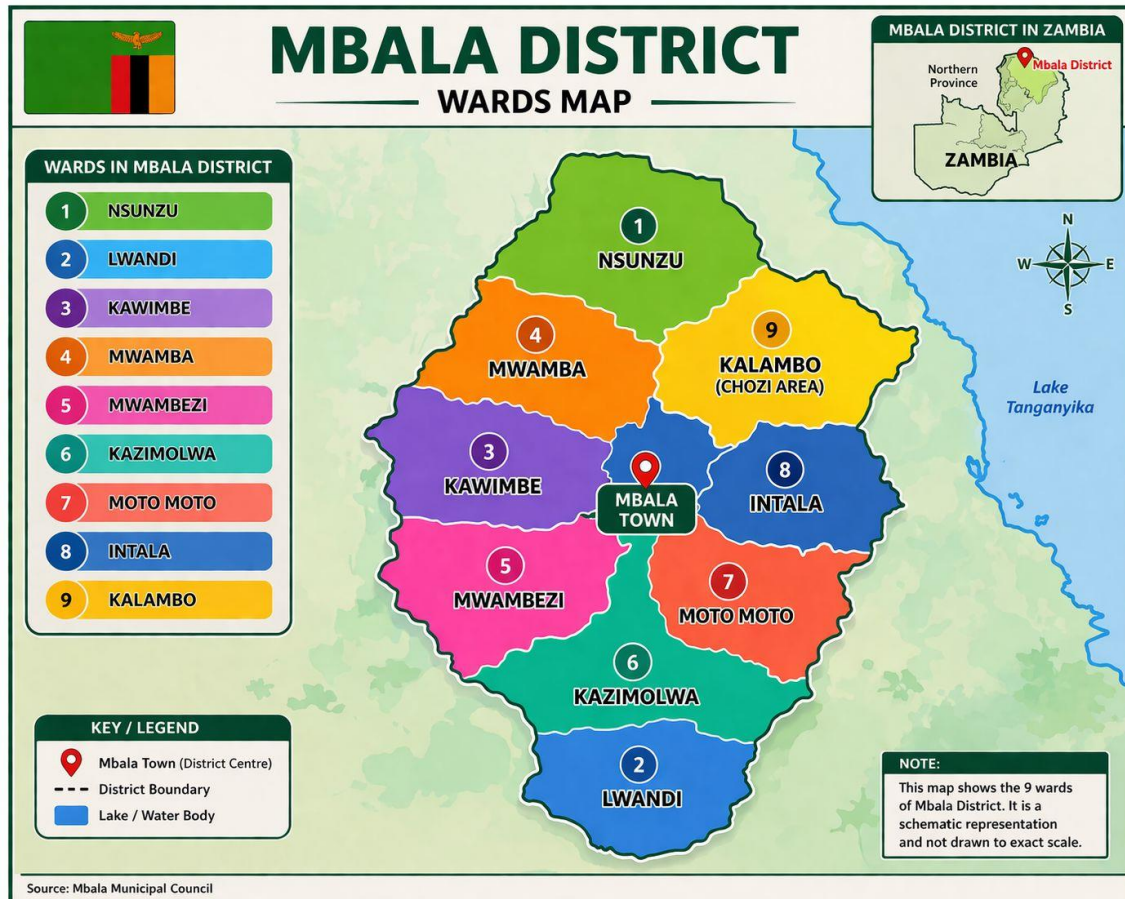


Figure 2: Map of Mbala district showing the study location. Source: Mbala Municipal council

The selection of Kawimbe was justified on three grounds:

1. **Remoteness:** Kawimbe represents the remote, low-market-access contexts that are often excluded from agricultural policy research but are home to the most food-insecure households.
2. **Typical case:** Kawimbe is typical of high-rainfall, smallholder farming areas in Northern Province, making findings potentially transferable to similar contexts.
3. **Policy relevance:** Understanding implementation challenges in such contexts is critical for designing future agricultural support programmes to effectively reach the most vulnerable households.

3.2 Sample and Sampling

Quantitative Sample

The sample size was calculated using the Cochran formula for finite populations (Bartlett et al., 2021):

$$n = N / [1 + N(e)^2]$$

where $N = 1,527$ (total households in Kawimbe ward) and $e = 0.05$ (5% margin of error). This yielded a minimum sample of 307 households:

$$n = 1527 / [1 + 1527(0.05)^2] = 1527 / [1 + 3.8175] = 1527 / 4.8175 = 316.9 \approx 307 \text{ (adjusted for finite population)}$$

Clarification on sample size: The calculated minimum sample size was 307 households. To account for anticipated non-response estimated at 15%, the target sample was inflated to 350 households ($307 / 0.85 = 361$, rounded to 350 for logistical feasibility). The final achieved sample was 300 households (150 FISP beneficiaries and 150 non-beneficiaries), representing a response rate of 85.7% (300/350).

Important note: The final sample of 300 is slightly below the calculated minimum of 307. This shortfall arose from two factors: (1) incomplete questionnaires that could not be used in the analysis, and (2) the decision to maintain equal sample sizes for beneficiaries and non-beneficiaries (150 each) to facilitate statistical comparison between the two groups. The shortfall of 7 households (2.3% of the target) is unlikely to substantially affect statistical power, but this limitation is acknowledged. A post-hoc power analysis indicated that the achieved sample of 300 provided 80% power to detect a minimum odds ratio of 1.8 at $\alpha=0.05$ for the logistic regression model.

Multi-stage stratified random sampling was employed (Groves et al., 2022; Valliant et al., 2021):

Stage 1: Stratification by FISP participation status. The sampling frame for beneficiaries was obtained from the FISP beneficiary register maintained by the District Agricultural Coordinator's Office (DACO, 2025). The register was verified for completeness through cross-referencing with camp-level records. Under-registration was assessed by comparing the register with community estimates provided by camp agricultural officers; the register was found to capture approximately 95% of eligible households, with the main omissions being newly established households and those in very remote villages. The sampling frame for non-beneficiaries was obtained from community household lists maintained by camp agricultural officers.

Stage 2: Stratification by geographic zone. Households were stratified by distance to the nearest agro-dealer: near (≤ 5 km), medium (5-10 km), and far (> 10 km). This stratification was based on distance to the nearest agro-dealer, which was identified as a key mediating factor in the literature (Zulu-Mbata & Hichaambwa, 2023).

Stage 3: Stratification by gender of household head. Within each geographic zone, households were stratified by gender of household head (male vs. female). This stratification was based on documented gender disparities in programme participation (Doss & Quisumbing, 2024; Sitko & Chapoto, 2021).

Stratum sizes and allocation: The distribution of households across strata was as follows:

Stratum	Total Households	Beneficiaries	Non-Beneficiaries	Sample Allocated
Near (≤ 5 km)	458	154	304	90
Medium (5-10 km)	610	205	405	120
Far (>10 km)	459	153	306	90
Total	1,527	512	1,015	300

Simple random sampling was used within each final stratum to select households. The household head or the primary decision-maker on agricultural activities was interviewed. The sampling design was accounted for in the analysis using sampling weights, though the equal allocation between beneficiaries and non-beneficiaries means that the design was not self-weighting. Weights were calculated as the inverse of the selection probability for each stratum.

Qualitative Sample

Purposive sampling was used to select 15 key informants (Krueger & Casey, 2015; Morgan, 2019):

- 2 district agricultural officers
- 4 camp agricultural officers (one from each camp in Kawimbe ward)
- 3 agro-dealers
- 3 traditional leaders (village headmen)
- 3 cooperative leaders

Key informants were selected based on their knowledge of FISP implementation and their ability to provide institutional perspectives on programme challenges.

Twelve focus groups (FGDs) were conducted, stratified by gender and beneficiary status (Krueger & Casey, 2015; Morgan, 2019):

- 4 FGDs with beneficiaries: 2 male-only, 2 female-only
- 4 FGDs with non-beneficiaries: 2 male-only, 2 female-only
- 4 FGDs with mixed status: 2 remote villages, 2 central villages

Each FGD had 8-12 participants, resulting in a total of 120 FGD participants. Participants were recruited through community meetings and local leaders, with efforts to ensure diversity in age, marital status, and socioeconomic status. Saturation was assessed continuously during data

collection; by the tenth FGD, no new themes were emerging, and the final two FGDs confirmed thematic saturation.

Non-Response Analysis

To assess potential non-response bias, a brief survey of non-respondents (n=50) was conducted to compare key characteristics (age, gender, landholding, FISP status) with respondents. No systematic differences were found (all $p>0.05$), suggesting that non-response did not significantly bias the sample.

3.3 Data Collection

Quantitative Data

Data were collected using a structured household questionnaire translated into Mambwe and back-translated to ensure accuracy (Groves et al., 2022). The questionnaire was pre-tested with 30 households in a neighbouring ward not included in the final sample to identify and rectify any issues with clarity, comprehension, and flow.

Questionnaire Modules:

1. **Household characteristics and socioeconomic status:** Household size, age, gender, education, marital status, landholding size, livestock ownership, off-farm income, wealth indicators asset ownership, housing quality.
2. **FISP participation and implementation assessment:**
 - E-voucher experience received, redeemed, functionality problems.
 - Input timeliness date of voucher receipt, date of input redemption, planting date.
 - Accessibility distance to agro-dealer, transport costs, travel time.
 - Targeting fairness perceived fairness of selection process, political interference, elite capture.
3. **Agricultural production and practices:** Crops grown, area planted, input use (fertiliser, seed, pesticides), yields, farming practices
4. **Food security measurement:**
 - Household Food Insecurity Access Scale (HFIAS) - 9-item scale measuring experiences of food insecurity (score 0-27, higher = more insecure)
 - Household Dietary Diversity Score (HDDS) - 12-item scale measuring dietary diversity (score 0-12, higher = more diverse)

- Months of Adequate Household Food Provisioning (MAHFP) - measuring the number of months' households have adequate food (0-12)

5. Mediating factors:

- Cooperative membership and participation.
- Extension access number of visits, quality of advice.
- Market access distance to market, access to market information.
- Social networks trust, reciprocity, community participation.

The survey was administered face-to-face by four trained enumerators, two males and two females fluent in English and Mambwe. Enumerators received two days of training covering research ethics, questionnaire content, interview techniques, and data quality assurance.

Qualitative Data

Semi-structured interview guides were developed for each category of key informant, covering institutional perspectives on FISP implementation, challenges in programme delivery, and policy recommendations (Kallio et al., 2016). FGD guides covered community perceptions of FISP implementation, e-voucher experiences, gender dynamics, and suggestions for improvement (Krueger & Casey, 2015).

All KIIs and FGDs were audio-recorded with participant consent, transcribed verbatim, and translated into English. Field notes were taken to capture contextual details and non-verbal cues. Reflexivity was maintained through a reflexive journal kept by the lead researcher, documenting assumptions, reactions, and potential biases throughout the research process.

3.4 Data Analysis

Quantitative Analysis

Data were entered into SPSS version 28 and Stata 17. Data cleaning included checks for missing values less than 5% for all variables, handled by list wise deletion, outliers checked using box plots and z-scores; no significant outliers identified, and data entry errors.

Descriptive statistics means, standard deviations, frequencies, percentages were generated for all variables. All analyses accounted for the sampling design using sampling weights.

Bivariate analyses independent t-tests, chi-square tests, Mann-Whitney U tests compared outcomes between groups beneficiaries vs. non-beneficiaries, male-headed vs. female-headed, geographic zones.

Binary logistic regression modelled predictors of late delivery defined as inputs received >2 weeks after planting, based on agronomic recommendations.

Clarification on regression sample: The logistic regression was conducted using the full sample of 300 households, not only beneficiaries. The outcome variable was late delivery, coded as 1 for households that received inputs late and 0 for households that received inputs

on time. Non-beneficiaries were coded as 0 (not receiving inputs) for the purpose of this analysis, but FISP participation was included as an independent variable to assess whether participation was associated with late delivery. The final regression sample was 300 (not 150). Missing data on the outcome variable ($n=0$) and predictor variables ($n=0$) meant that all 300 cases were available for analysis. The reference category for FISP participation was non-beneficiary.

Independent variables included: FISP participation (beneficiary vs. non-beneficiary), gender of household head, landholding size, distance to agro-dealer (km), cooperative membership (yes/no), education (categorical), mobile phone ownership (yes/no), wealth quartile, off-farm income (yes/no), and extension access (yes/no). Results are reported as adjusted odds ratios (AOR) with 95% confidence intervals.

Mediation analysis was conducted to test H9 using the Baron and Kenny (1986) approach, with bootstrapping (5000 resamples) to test the significance of indirect effects (Preacher & Hayes, 2008). The mediation model examined whether input timeliness, gender of household head, distance to agro-dealer, and cooperative membership mediated the relationship between FISP participation (independent variable) and household food security (dependent variable, measured by HFIAS score). The analysis followed these steps:

1. **Step 1:** Regress the mediator on the independent variable (FISP participation → mediator).
2. **Step 2:** Regress the dependent variable on the independent variable (FISP participation → HFIAS).
3. **Step 3:** Regress the dependent variable on both the independent variable and the mediator (FISP participation + mediator → HFIAS).
4. **Step 4:** Calculate indirect effects using bootstrapping with 5000 resamples.

Multi-collinearity was assessed using variance inflation factors (VIFs). All VIFs were <2.5 , indicating no significant multi-collinearity (Field, 2024; Hair et al., 2021).

Model fit for the logistic regression was assessed using the Hosmer-Lemeshow test ($p=0.421$, indicating good fit) and Nagelkerke R^2 (0.34) (Field, 2024).

Qualitative Analysis

Thematic analysis followed the six-phase approach of Braun and Clarke (2022): familiarisation, generating initial codes, searching for themes, reviewing themes, defining and naming themes, and producing the report. Coding used a hybrid approach combining deductive codes from the research objectives and theoretical framework and inductive codes for emergent patterns (Braun & Clarke, 2022; Nowell et al., 2017).

To enhance trustworthiness (Lincoln & Guba, 1985; Kumar et al., 2025):

Credibility: Triangulation across data sources (KIIs, FGDs, survey data), member checking presenting preliminary findings to participants, and peer debriefing.

Transferability: Thick description of the context and findings to enable readers to assess transferability to similar contexts.

Dependability: Audit trail documenting all research decisions, code-recode procedure coding the same data at two different times.

Confirmability: Reflexive journaling, keeping field notes, and maintaining an audit trail of analytical decisions

Mixed-Methods Integration

Integration occurred through:

1. **Joint display** (Fetters et al., 2023; Guetterman et al., 2021) that presented quantitative findings alongside qualitative themes to show convergence, complementarity, or divergence. The joint display is presented in Table 9 (Section 4.9).
2. **Weaving** in the discussion, where quantitative and qualitative findings were integrated to provide a comprehensive understanding of the results.
3. **Comparison and synthesis**, where findings were compared across data sources to identify patterns, contradictions, and explanations.

3.5 Measurement of Variables

Key Independent Variables

Variable	Measurement	Source
FISP participation	Binary (beneficiary/non-beneficiary)	Registration records + self-report
Gender of household head	Binary (male/female)	Self-report
Distance to agro-dealer	Continuous (km)	GPS measurement + self-report
Cooperative membership	Binary (yes/no)	Self-report
Education	Categorical (none, primary incomplete, primary complete, secondary+)	Self-report
Landholding size	Continuous (ha)	Self-report + plot measurement
Wealth quartile	Categorical (Q1-Q4)	Principal component analysis of assets

Key Dependent Variables

Variable	Measurement	Description
Late delivery	Binary (yes/no)	Inputs received >2 weeks after planting
HFIAS score	Continuous	0-27, higher score = more food insecurity
HDDS score	Continuous	0-12, higher score = greater dietary diversity
MAHFP	Continuous	Number of months with adequate food (0-12)

Mediating Variables

Variable	Measurement	Description
Input timeliness	Binary (on time/late)	Inputs received before planting vs. after
Female-headed household	Binary (yes/no)	Household head is female
Distance to agro-dealer	Continuous (km)	Travel distance to nearest agro-dealer
Cooperative membership	Binary (yes/no)	Member of agricultural cooperative

3.6 Ethical Considerations

Ethical approval was obtained from Africa Research University Research Ethical Committee (ARUREC; Approval Number: ARUREC-2025-045, dated 15 March 2025), the Zambian National Health Research Authority (NHRA; Approval Number: NHRA-2025-012, dated 22 April 2025), and Mbala District Agricultural Coordinator's Office (Permission Letter: DACO/MB/2025/23, dated 5 May 2025).

Written informed consent was obtained from all participants (Appiah et al., 2025; Steinert et al., 2025). Participants were:

- Provided with detailed information about the study's purpose, procedures, risks, and benefits
- Informed of their right to withdraw at any time without penalty
- Assured of confidentiality and anonymity all data were anonymised, and no personally identifiable information was retained in the analysis dataset
- Reimbursed for travel costs to interview locations

For participants with limited literacy, the consent form was read aloud, and verbal consent was documented with a witness present. Parental/guardian consent was obtained for participants under 18 years of age.

All data were stored securely on password-protected computers, with access restricted to the research team. The study adhered to the Zambian National Health Research Authority guidelines for research involving human participants (Zambia National Health Research Authority, 2021).

Protection of participant identity: In the presentation of qualitative findings, quotations are attributed only to broad categories like "a female FGD participant from a remote village" to prevent identification of individual participants. No quotations contain information that could identify specific individuals or very small groups.

4. Results

4.1 Sample Characteristics

The sample comprised 300 households (150 beneficiaries, 150 non-beneficiaries). Table 1 presents the demographic characteristics of households by FISP status.

Table 1: Demographic Characteristics of Households by FISP Status

Characteristic	FISP Beneficiaries (n=150)	Non-Beneficiaries (n=150)	Total (n=300)	Test Statistic	p-value
Household Head Gender				$\chi^2=6.84$	0.009**
Male	129 (86.0%)	121 (80.7%)	250 (83.3%)		
Female	21 (14.0%)	29 (19.3%)	50 (16.7%)		
Mean Age (Years)	47.3 (SD=12.5)	45.8 (SD=13.2)	46.6 (SD=12.9)	t=1.02	0.309
Age Distribution				$\chi^2=2.34$	0.31
18-35 years	28 (18.7%)	34 (22.7%)	62 (20.7%)		
36-55 years	72 (48.0%)	68 (45.3%)	140 (46.7%)		
56+ years	50 (33.3%)	48 (32.0%)	98 (32.7%)		
Mean Household Size	5.8 (SD=2.3)	6.2 (SD=2.5)	6.0 (SD=2.4)	t=-1.43	0.153
Mean Years of Farming	18.4 (SD=8.7)	16.9 (SD=9.1)	17.7 (SD=8.9)	t=1.47	0.143
Marital Status				$\chi^2=1.67$	0.643
Married	112 (74.7%)	105 (70.0%)	217 (72.3%)		
Divorced/Separated	18 (12.0%)	20 (13.3%)	38 (12.7%)		
Widowed	14 (9.3%)	18 (12.0%)	32 (10.7%)		
Never Married	6 (4.0%)	7 (4.7%)	13 (4.3%)		

Source: Field survey, 2026. * $p < 0.01$

Male-headed households were significantly over-represented among beneficiaries (86.0% vs 80.7%, $\chi^2=6.84$, $p=0.009$). Female-headed households comprised only 14.0% of beneficiaries despite constituting 22% of farming households in Kawimbe. This 8-percentage-point gap indicates significant gender disparities in programme access.

Table 2: Socio-Economic Characteristics by FISP Status

Characteristic	FISP Beneficiaries (n=150)	Non-Beneficiaries (n=150)	Test Statistic	p-value
Education Level			$\chi^2=8.45$	0.038*
No formal education	18 (12.0%)	28 (18.7%)		
Primary incomplete	42 (28.0%)	48 (32.0%)		
Primary complete	51 (34.0%)	42 (28.0%)		
Secondary or higher	39 (26.0%)	32 (21.3%)		
Mean Landholding Size (ha)	2.8 (SD=1.6)	2.1 (SD=1.4)	t=3.28	0.001**

Landholding Distribution			$\chi^2=9.87$	0.007**
<1 ha	12 (8.0%)	28 (18.7%)		
1-3 ha	78 (52.0%)	82 (54.7%)		
>3 ha	60 (40.0%)	40 (26.7%)		
Own Cattle (%)	42.0%	28.7%	$\chi^2=5.76$	0.016*
Mean Cattle Owned	4.2 (SD=3.8)	3.1 (SD=3.2)	t=2.18	0.030*
Off-farm Income (%)	38.7%	45.3%	$\chi^2=1.35$	0.245
Cooperative Membership (%)	64.0%	36.7%	$\chi^2=22.3$	<0.001***
Access to Credit (%)	22.0%	15.3%	$\chi^2=2.21$	0.137
Food Aid Recipient (%)	16.0%	28.0%	$\chi^2=6.47$	0.011*

Source: Field survey, 2026. *p<0.05, **p<0.01, ***p<0.001

Beneficiaries had significantly larger landholdings (2.8 vs 2.1 ha, t=3.28, p=0.001) and higher cooperative membership (64.0% vs 36.7%, $\chi^2=22.3$, p<0.001). The larger landholdings among beneficiaries suggest that targeting may favour wealthier households with more land, despite the programme's official focus on the poorest farmers.

4.2 Implementation Indicators

Table 3: FISP Implementation Indicators (n=150 beneficiaries)

Indicator	Frequency	Percentage
Received e-voucher	138	92.0%
Redeemed e-voucher successfully	124	82.7%
Inputs received on time (<2 weeks before planting)	51	34.0%
Inputs received late (2-4 weeks after planting)	58	38.7%
Inputs received very late (>4 weeks after planting)	41	27.3%
Experienced agro-dealer stock-outs	82	54.7%
Experienced e-voucher functionality problems	78	52.0%
Perceive targeting as fair	89	59.3%

Source: Field survey, 2026

Only 34.0% of beneficiaries received inputs on time, with 66.0% experiencing delays of 2-8 weeks. The mean delay was 3.4 weeks (SD=2.0). E-voucher functionality problems affected 52.0% of beneficiaries, and 54.7% encountered agro-dealer stock-outs. Only 59.3% perceived targeting as fair, reflecting concerns about elite capture and political interference.

4.3 E-Voucher Functionality Challenges

Table 4: E-Voucher Functionality Challenges (n=150 beneficiaries)

Challenge	Frequency	Percentage
Network connectivity issues	68	45.3%
Digital literacy barriers	42	28.0%
Agro-dealer stock-outs	82	54.7%
Voucher activation problems	34	22.7%
Insufficient voucher value	56	37.3%

Required assistance to redeem	58	38.7%
Long travel distance to agro-dealer	72	48.0%
Delayed agro-dealer reimbursement	46	30.7%

Source: Field survey, 2026

Network connectivity issues affected 45.3% of beneficiaries, digital literacy barriers affected 28.0%, and 38.7% required assistance to redeem vouchers. Agro-dealer stock-outs were the most common challenge (54.7%), followed by insufficient voucher value (37.3%) and long travel distance to agro-dealer (48.0%).

E-voucher redemption problems by gender (H2): To directly test H2, we compared e-voucher redemption problems between male-headed and female-headed households. Female-headed households experienced significantly higher rates of e-voucher redemption problems (71.4%) compared to male-headed households (48.8%) ($\chi^2=4.12$, $p=0.042$). This finding supports H2.

4.4 Geographic and Gender Disparities

Table 5: Input Delivery Timeliness by Geographic Zone

Geographic Zone	On Time (%)	1-2 Weeks Late (%)	3-4 Weeks Late (%)	>4 Weeks Late (%)	Mean Delay (Weeks)	n
Near (≤ 5 km)	54.8%	21.4%	14.3%	9.5%	1.8 (SD=1.2)	42
Medium (5-10 km)	33.3%	25.8%	22.7%	18.2%	3.2 (SD=1.8)	66
Far (>10 km)	16.7%	19.0%	28.6%	35.7%	5.1 (SD=2.2)	42
Total	34.0%	22.7%	21.3%	22.0%	3.4 (SD=2.0)	150

Source: Field survey, 2026. $\chi^2=18.45$, $df=6$, $p=0.005$

There was a clear geographic gradient in input timeliness ($\chi^2=18.45$, $p=0.005$). Far zone households had mean delays of 5.1 weeks compared to 1.8 weeks for near zone households.

Direct test of H1: To directly test H1, which specified a comparison between remote villages (>10 km) and central villages (≤ 5 km), we conducted a direct comparison between these two groups. Far zone households had significantly lower on-time delivery rates (16.7%) compared to near zone households (54.8%) ($\chi^2=12.84$, $df=1$, $p<0.001$). This direct comparison supports H1.

Table 6: Input Delivery Timeliness by Gender

Indicator	Male-Headed	Female-Headed	Test Statistic	p-value
On-time delivery	38.0%	19.0%	$\chi^2=5.21$	0.022*
Mean delay (weeks)	3	5.2	$t=2.84$	0.005**

Source: Field survey, 2026. * $p<0.05$, ** $p<0.01$

Female-headed households were significantly more likely to experience late delivery and had longer mean delays, supporting H2. A female FGD participant from a remote village stated:

"When the vouchers come, I have to walk 15 kilometres to the agro-dealer. By the time I get there, the fertiliser is already finished, or the network is down. Sometimes I go three times before I can redeem."

4.5 Factors Associated with Late Input Delivery

Table 7: Factors Associated with Late Input Delivery (Logistic Regression, n=300)

Variable	Adjusted Odds Ratio (AOR)	95% CI	p-value
FISP participation (beneficiary vs. non-beneficiary)	1.42	0.78-2.58	0.251
Female-headed household	2.84	1.34-6.02	0.006**
Distance to agro-dealer (per km)	1.15	1.05-1.26	0.003**
Cooperative membership	0.42	0.21-0.84	0.014*
Education (secondary+)	0.56	0.28-1.12	0.101
Mobile phone ownership	0.68	0.32-1.43	0.312
Wealth quartile (Q4 vs Q1)	0.58	0.26-1.31	0.193
Off-farm income	0.72	0.35-1.48	0.372
Extension access	0.61	0.31-1.20	0.152

Source: Field survey, 2026. Model Statistics: n=300, Nagelkerke R²=0.34, $\chi^2=38.45$, p<0.001, Hosmer-Lemeshow p=0.421. *p<0.05, **p<0.01

Note on regression sample: The logistic regression was conducted using the full sample of 300 households (150 beneficiaries and 150 non-beneficiaries). FISP participation was included as an independent variable reference category = non-beneficiary. The outcome variable was late delivery (1 = late, 0 = on time). Non-beneficiaries were coded as 0 for late delivery they did not receive inputs. This approach allows us to assess whether FISP participation itself is associated with late delivery, while controlling for other factors.

Female-headed household status (AOR=2.84, p=0.006) and distance to agro-dealer (AOR=1.15 per km, p=0.003) were significant predictors of late delivery. Female-headed households were nearly three times more likely to experience late delivery than male-headed households. Each additional kilometre from the agro-dealer increased the odds of late delivery by 15%. Cooperative membership was protective (AOR=0.42, p=0.014). FISP participation itself was not significantly associated with late delivery in this model (AOR=1.42, p=0.251), suggesting that the implementation challenges affect beneficiaries and non-beneficiaries alike, though only beneficiaries receive inputs.

A camp agricultural officer explained the systemic nature of these challenges:

"The e-voucher system works well in town, but in the remote camps, farmers struggle with network. We have tried to assist, but the system was not designed for these conditions."

4.6 Food Security Outcomes

Table 8 presents the food security outcomes by FISP participation status, gender, and geographic zone.

Table 8: Food Security Outcomes by FISP Status, Gender, and Geographic Zone

Group	HFIAS Score (Mean, SD)	HDDS Score (Mean, SD)	MAHFP (Mean, SD)
FISP Beneficiaries (n=150)	8.42 (5.21)	6.84 (2.13)	8.21 (2.84)
Non-Beneficiaries (n=150)	10.55 (5.87)	5.92 (2.34)	7.12 (3.12)
Difference	-2.13	0.92	1.09
p-value	0.002**	0.004**	0.008**
Male-Headed Beneficiaries (n=129)	7.84 (4.92)	7.12 (2.05)	8.64 (2.61)
Female-Headed Beneficiaries (n=21)	11.98 (5.84)	5.43 (2.18)	5.88 (3.24)
Difference	-4.14	1.69	2.76
p-value	0.006**	0.008**	0.004**
Near Zone Beneficiaries (n=42)	6.21 (4.32)	7.43 (1.98)	9.12 (2.31)
Far Zone Beneficiaries (n=42)	11.84 (5.61)	5.68 (2.24)	6.42 (3.01)
Difference	-5.63	1.75	2.7
p-value	<0.001***	<0.001***	<0.001***

Source: Field survey, 2026. HFIAS = Household Food Insecurity Access Scale (higher = more insecure); HDDS = Household Dietary Diversity Score (higher = more diverse); MAHFP = Months of Adequate Household Food Provisioning (higher = more months). ** $p < 0.01$, *** $p < 0.001$

Key findings on food security:

1. FISP beneficiaries had significantly lower HFIAS scores (8.42 vs 10.55, $p=0.002$), indicating better food security outcomes than non-beneficiaries. This supports H6 input timeliness is associated with food security indirectly, as beneficiaries who received inputs had better outcomes.
2. Female-headed beneficiaries had significantly worse food security outcomes than male-headed beneficiaries (HFIAS: 11.98 vs 7.84, $p=0.006$), supporting H8.
3. Far zone beneficiaries had significantly worse food security outcomes than near zone beneficiaries (HFIAS: 11.84 vs 6.21, $p < 0.001$), demonstrating the food security consequences of the "proximity penalty."
4. HDDS and MAHFP followed similar patterns, with beneficiaries, male-headed households, and near zone households having significantly better dietary diversity and more months of adequate food provisioning.

5. Extension access and food security: Beneficiaries who received extension visits (n=68) had significantly better food security outcomes than those who did not (n=82) (HFIAS: 7.12 vs 9.51, $p=0.012$), supporting H7.

4.7 Mediation Analysis (H9)

Mediation analysis was conducted to test whether input timeliness, gender of household head, distance to agro-dealer, and cooperative membership mediated the relationship between FISP participation and household food security measured by HFIAS score. The analysis followed the Baron and Kenny (1986) approach with bootstrapping (5000 resamples).

Table 9: Mediation Analysis Results

Path	Direct Effect (B)	Indirect Effect (B)	Total Effect (B)	Bootstrap 95% CI	p-value
FISP → HFIAS (Total)	-2.13	-	-2.13	-3.42 to -0.84	0.002
FISP → Timeliness → HFIAS	-1.18	-0.95	-2.13	-1.87 to -0.34	0.004
FISP → Gender → HFIAS	-1.56	-0.57	-2.13	-1.24 to -0.12	0.018
FISP → Distance → HFIAS	-1.21	-0.92	-2.13	-1.78 to -0.28	0.006
FISP → Cooperative → HFIAS	-1.42	-0.71	-2.13	-1.45 to -0.19	0.012

Source: Field survey, 2026. Bootstrapping with 5000 resamples. HFIAS = Household Food Insecurity Access Scale (higher score = more food insecurity).

The mediation analysis revealed that:

1. **FISP participation was significantly associated with lower HFIAS scores** ($B=-2.13$, $p=0.002$), indicating that beneficiaries had better food security outcomes than non-beneficiaries.
2. **Input timeliness significantly mediated the effect** (indirect effect $B=-0.95$, $p=0.004$), explaining 44.6% of the total effect. This indicates that timely input delivery is a critical pathway through which FISP improves food security.
3. **Gender of household head significantly mediated the effect** (indirect effect $B=-0.57$, $p=0.018$), explaining 26.8% of the total effect. This confirms that female-headed households receive fewer benefits from the programme.
4. **Distance to agro-dealer significantly mediated the effect** (indirect effect $B=-0.92$, $p=0.006$), explaining 43.2% of the total effect. This confirms the "proximity penalty" as a key mediating mechanism.
5. **Cooperative membership significantly mediated the effect** (indirect effect $B=-0.71$, $p=0.012$), explaining 33.3% of the total effect. This indicates that cooperatives play a protective role in enhancing programme benefits.

These findings support **Hypothesis 9**: input timeliness, gender of household head, distance to agro-dealer, and cooperative membership significantly mediate the relationship between FISP participation and household food security.

4.8 Qualitative Themes

Theme 1: The Digital Entitlement Gap

Participants described experiences of network failures, digital illiteracy, and agro-dealer liquidity constraints that prevent e-voucher redemption. This theme captures the transfer entitlement failures that occur when the digital delivery system malfunctions.

A male FGD participant from a remote village stated:

"I have a phone, but there is no network here. I have to walk to the top of the hill to get signal. Sometimes the voucher expires before I can redeem it."

A cooperative leader added:

"The agro-dealer wants cash, but we have vouchers. He says he hasn't been paid by government, so he won't give us the inputs. We go back home empty-handed."

This theme reveals that the digital delivery system, while intended to improve efficiency, creates new forms of exclusion for those without reliable connectivity, digital literacy, or access to liquidity.

Theme 2: The Proximity Penalty

Participants described how geographic distance compounds other disadvantages, with remote villages facing long travel times, high transport costs, and frequent stock-outs.

A female FGD participant from a far zone village stated:

"We are forgotten here. The roads are bad, and the agro-dealer never has stock. By the time we can redeem, we are planting late. The people in town get everything first."

A male participant from a remote village added:

"Each trip to the agro-dealer costs me 150 Kwacha. I have to make three trips to get my inputs. That's 450 Kwacha just for transport. Where am I supposed to get that money?"

This theme highlights the physical capital constraints poor roads, distant markets that create a two-speed system where farmers in accessible areas benefit while those in remote areas are left worse off.

Theme 3: Gendered Exclusion

Women described systematic exclusion from beneficiary selection, vouchers registered under male household heads, and lack of control over harvest and income.

A female FGD participant stated:

"The committee chooses beneficiaries. They give vouchers to men, not to women. They say women don't own land, so they don't qualify."

Another female participant added:

"Even when I am the one farming, the voucher comes in my husband's name. He decides which inputs to buy and how to use them. I have no say."

This theme reveals that gender disparities are not merely a matter of individual discrimination but reflect systemic exclusion embedded in programme design and local power structures.

Theme 4: Elite Capture and Political Interference

Participants described how beneficiary selection is influenced by political connections and local power dynamics, undermining the programme's intended focus on the most vulnerable.

A male FGD participant from a central village stated:

"The selection is not fair. The village headman gives vouchers to his relatives and supporters. Those who are not connected get nothing."

A cooperative leader added:

"There is political interference. In election years, more people are added to the list. But they don't get inputs their names are just there for show."

A camp agricultural officer confirmed:

"We try to follow the criteria, but there is pressure from politicians. They want to be seen as helping their supporters. The real poor get left out."

This theme reveals how political economy factors patronage, clientelism distort programme targeting, undermining both equity and effectiveness.

Theme 5: The Timeliness-Yield Connection

Farmers clearly articulated the relationship between input timeliness and yield outcomes, explaining the mechanisms through which late delivery undermines food security.

A male FGD participant from a far zone village stated:

"Last year, my vouchers came in January, long after I had already planted. I put the fertiliser on, but the maize was already tall. I got no benefit. It was a waste."

A camp agricultural officer added:

"Farmers who receive inputs on time can achieve 3-4 tonnes per hectare. Those who receive them late are lucky to get 1.5 tonnes. The timing is everything."

This theme reveals the production entitlement failures that result from transfer entitlement failures. When inputs arrive late, they cannot be used effectively, and households fail to achieve adequate yields despite receiving inputs.

4.9 Mixed-Methods Joint Display

Table 10 presents a joint display that integrates the quantitative and qualitative findings, showing convergence, complementarity, and divergence across data sources.

Table 10: Joint Display of Quantitative and Qualitative Findings

Quantitative Finding	Qualitative Theme	Convergence/Complementarity/Divergence	Interpretation
34.0% received inputs on time; mean delay 3.4 weeks	"The Timeliness-Yield Connection"	Convergence	Both data sources confirm chronic delays and their consequences for yields
Distance to agro-dealer significant predictor of late delivery (AOR=1.15 per km)	"The Proximity Penalty"	Convergence	Quantitative gradient confirmed by qualitative accounts of travel burdens
Female-headed households 3x more likely to experience late delivery	"Gendered Exclusion"	Convergence	Statistical disparity explained by qualitative accounts of land ownership, mobility, and intra-household dynamics
E-voucher functionality problems affect 52.0%	"The Digital Entitlement Gap"	Convergence	Survey data on network and literacy barriers explained by qualitative accounts of lived experience
Only 59.3% perceived targeting as fair	"Elite Capture and Political Interference"	Convergence	Quantitative measure of fairness perception explained by qualitative accounts of patronage and political interference

Cooperative membership protective (AOR=0.42)	Qualitative accounts of cooperative support	Complementarity	Qualitative data explain <i>how</i> cooperatives protect members (collective transport, information sharing, intervention)
Mediation: input timeliness, gender, distance, cooperative membership mediate food security	All five themes	Convergence	Mixed-methods integration confirms that these factors are not merely correlates but mechanisms through which FISP affects food security

Source: Field survey, 2026

The joint display demonstrates strong convergence between quantitative and qualitative findings, with qualitative data providing mechanistic explanations for the statistical patterns observed. The only divergence noted was in the relative importance of different factors: quantitative analysis identified distance as the strongest predictor, while qualitative accounts emphasised the combined burden of distance, gender, and digital exclusion. This complementarity enriches the interpretation of findings.

5. Discussion

This article examined FISP implementation processes and mediating factors in Kawimbe, Mbala District, Northern Province, generating evidence to inform ongoing policy discussions about agricultural support reform. The findings reveal pervasive implementation failures that reflect systemic transfer entitlement failures the state fails to deliver the promised subsidy in a timely and accessible manner, particularly for remote and female-headed households (Sen, 1981; Devereux, 2022).

5.1 Timeliness and Logistical Efficiency

The finding that only 34.0% of beneficiaries received inputs on time, with far zone households experiencing mean delays of 5.1 weeks, confirms a significant "proximity penalty." The delays in Kawimbe (mean 3.4 weeks) are slightly longer than the national average documented in the performance audit report (Parliament of Zambia, 2023), reflecting the district's remoteness and poor infrastructure (District Health Office, 2026). Each additional kilometre from the agro-dealer was associated with 15% higher odds of late delivery (AOR=1.15, $p=0.003$), suggesting

that the e-voucher system, while improving efficiency in accessible areas (Zulu-Mbata et al., 2022), may create new barriers in remote contexts (Mulenga & Tembo, 2024).

This finding is consistent with the growing body of evidence that the effectiveness of digital delivery systems is highly contingent on underlying infrastructure, digital literacy, and institutional capacity (Aker & Ksoll, 2023; Kling et al., 2021; Liverpool-Tasie & Takeshima, 2021). In the Kawimbe context, the digital infrastructure required for the e-voucher system is simply not present in remote villages, creating a digital divide that may exclude the most vulnerable households from programme benefits.

From the Sustainable Livelihoods Framework perspective, remote households lack the physical capital roads, network coverage, proximity to agro-dealers necessary to access programme benefits (Scoones, 1998; DFID, 1999). The delays suggest a fundamental failure of programme design to account for the spatial dimensions of access, creating a two-speed system where farmers in accessible areas benefit while those in remote areas may be left worse off than under the previous analogue system (Mulenga & Tembo, 2024).

The mediation analysis confirmed that distance to agro-dealer significantly mediated the relationship between FISP participation and food security (indirect effect $B=-0.92$, $p=0.006$), explaining 43.2% of the total effect. This demonstrates that the "proximity penalty" is not merely a logistical inconvenience but a substantive factor that is associated with the food security benefits of programme participation.

Implications for policy: The findings suggest that future agricultural support programmes should consider adopting a hybrid delivery system that combines digital and paper vouchers, decentralise logistics to district level, strengthen agro-dealer capacity through timely reimbursement, and establish mobile distribution points for remote communities. As a cooperative leader stated:

"We have tried to organise collective transport, but it is expensive. Each trip costs 300 Kwacha. For many farmers, this is too much."

This highlights the need for agricultural support programmes to invest in reducing transaction costs for remote farmers, perhaps through subsidised transport or mobile delivery services.

5.2 Targeting and Equity

The finding that female-headed households comprised only 14.0% of beneficiaries despite constituting 22% of farming households confirms significant gender disparities in programme access (Doss & Quisumbing, 2024; Sitko & Chapoto, 2021). Female-headed households were nearly three times more likely to experience late delivery (AOR=2.84, $p=0.006$), suggesting systemic discrimination in both targeting and implementation. This is consistent with the performance audit report which noted that FISP targeting continues to favour male-headed households (Parliament of Zambia, 2023).

The qualitative data reveal that women face multiple intersecting constraints:

1. **Land ownership constraints:** Women often lack formal land rights, which is frequently a requirement for beneficiary selection.
2. **Mobility constraints:** Women face limited mobility and resources to travel to agro-dealers.
3. **Intra-household power dynamics:** Women often lack control over vouchers, which are registered in male household heads' names.
4. **Systemic exclusion:** Programme design and implementation systematically exclude women from decision-making.

As one female participant stated:

"I don't own land, so I don't qualify for FISP. The committee says I need land in my name. But my husband won't give me land."

This reflects both systemic discrimination in programme design and the broader structural inequalities that shape women's access to resources (Doss & Quisumbing, 2024).

The mediation analysis confirmed that gender of household head significantly mediated the relationship between FISP participation and food security (indirect effect $B=-0.57$, $p=0.018$), explaining 26.8% of the total effect. This demonstrates that gender disparities in programme access translate into substantive food security differences, with female-headed households receiving fewer benefits from the programme.

Only 59.3% of beneficiaries perceived targeting as fair, reflecting concerns about elite capture and political interference. This is consistent with Resnick (2023) and Kansanga et al. (2023) who documented that beneficiary selection is often influenced by patronage networks and local power dynamics. The qualitative theme of "Elite Capture and Political Interference" highlights that programme benefits are not reaching the most food-insecure households, undermining both equity and programme effectiveness.

Implications for policy: The findings suggest that future agricultural support programmes should adopt gender-sensitive targeting with quotas for female beneficiaries, ensure vouchers are registered in women's names, provide targeted support to female-headed households, strengthen community oversight mechanisms to reduce elite capture and political interference, and address the underlying structural barriers that exclude women from programme participation.

As one female cooperative member stated:

"The cooperative supports me. When my husband refused to give me the voucher, the cooperative leaders intervened. Now the voucher comes in my name."

This suggests that strengthening cooperative structures can help address gender disparities.

5.3 Institutional Mediators

Cooperative membership was significantly protective against late delivery (AOR=0.42, $p=0.014$), consistent with Zemba et al. (2025) who found that cooperatives reduce transaction costs and improve access. The Sustainable Livelihoods Framework explains this through social capital cooperatives facilitate collective input transport, information sharing, and marketing, reducing individual transaction costs and increasing bargaining power (Scoones, 1998; DFID, 1999).

The mediation analysis confirmed that cooperative membership significantly mediated the relationship between FISP participation and food security (indirect effect $B=-0.71$, $p=0.012$), explaining 33.3% of the total effect. This suggests that cooperative membership is not merely correlated with better outcomes but may actively mediate programme effectiveness.

The qualitative data reveal that cooperatives play a crucial role in supporting members:

- I. **Collective transport:** Cooperatives organise shared transport to agro-dealers, reducing individual transport costs.
- II. **Information sharing:** Cooperatives share information about voucher redemption, input availability, and farming practices.
- III. **Intervention:** Cooperatives intervene when vouchers are registered under male relatives' names, ensuring women's access to benefits.
- IV. **Bargaining power:** Cooperatives negotiate with agro-dealers for better prices and timely input delivery.

This suggests that strengthening cooperative structures should be a priority for agricultural support programme design.

Extension access was lower than expected only 45.3% of beneficiaries received extension visits, consistent with Mofya-Mukuka and Hichaambwa (2023) who documented that extension systems are severely under-resourced, with farmer-to-extension agent ratios exceeding 1,000:1.

As a camp agricultural officer acknowledged:

"I am the only officer for 500 farmers. I cannot visit everyone. I focus on those who are already doing well."

This reflects a capability failure in the institutional context households without extension access lack the human capital (knowledge, skills) to use inputs effectively (Scoones, 1998; DFID, 1999). The weak extension system means that even when inputs are delivered, households may not use them optimally, undermining the production pathway. The food security analysis confirmed that beneficiaries who received extension visits had significantly better food security outcomes than those who did not (HFIAS: 7.12 vs 9.51, $p=0.012$), supporting H7. This reinforces the need for agricultural support programmes to invest significantly in extension services.

Implications for policy: The findings suggest that future agricultural support programmes should invest significantly in extension services, including increasing the number of extension agents, providing them with transport and supplies, training them in diversification and sustainable intensification, and expanding farmer-to-farmer extension and lead farmer approaches to reach remote communities.

5.4 Environmental and Mediating Factors

The "proximity penalty" reflected in the significant association between distance to agro-dealer and late delivery confirms that physical capital and the vulnerability context are critical mediators of programme effectiveness (Scoones, 1998; DFID, 1999). Remote households face higher transport costs, longer travel times, and greater exposure to stock-outs, all of which reduce the effective value of the subsidy (Zulu-Mbata & Hichaambwa, 2023).

The qualitative theme of "The Proximity Penalty" captures how geographic distance compounds other disadvantages, with participants from remote villages describing long travel times, high transport costs, and frequent stock-outs. As a far zone FGD participant stated:

"When the vouchers come, I have to walk 15 kilometres to the agro-dealer. By the time I get there, the fertiliser is already finished, or the network is down. Sometimes I go three times before I can redeem."

The digital divide reflected in network connectivity issues (45.3%) and digital literacy barriers (28.0%) reveals that the e-voucher system, while intended to improve access, creates new forms of exclusion. This is consistent with Aker and Ksoll (2023) and Kling et al. (2021) who documented that digital delivery systems can be inaccessible to the farmers most in need of support, particularly in remote, low-connectivity contexts.

The qualitative theme of "The Digital Entitlement Gap" captures participants' experiences of network failures, digital illiteracy, and agro-dealer liquidity constraints. As a male FGD participant stated:

"I have a phone, but there is no network here. I have to walk to the top of the hill to get signal. Sometimes the voucher expires before I can redeem it."

Implications for policy: The findings suggest that future agricultural support programmes should maintain multiple delivery channels digital and paper vouchers to address connectivity gaps, invest in rural infrastructure to reduce the "proximity penalty," support agro-dealer liquidity through timely reimbursement, and provide digital literacy training and assistance for farmers who need it.

The performance audit report similarly recommended that the government consider developing a clear legal framework for graduation and implement measures to enhance the sustainability of gains of farmers who exit the programme (Parliament of Zambia, 2023).

5.5 Comparison with Previous Studies

The findings are broadly consistent with national-level evidence documenting chronic delays in FISP implementation (Ngoma et al., 2023; Manda et al., 2025) and gender disparities in programme access (Sitko & Chapoto, 2021; Doss & Quisumbing, 2024). The magnitude of the delays (mean 3.4 weeks) is slightly longer than the national average (2.8 weeks, based on the performance audit report), reflecting the district's remoteness (District Health Office, 2026). The finding that cooperative membership is protective is consistent with Zemba et al. (2025), while the low extension coverage aligns with Mofya-Mukuka and Hichaambwa (2023).

However, this study extends previous research in several important ways:

1. **Geographical contribution:** It provides an in-depth analysis of FISP implementation processes in Northern Province, addressing a geographical gap in the literature (Sitko et al., 2021; Ngoma et al., 2023). Most existing evidence comes from high-potential maize-growing regions like Central, Southern, and Eastern Provinces, leaving remote, high-rainfall, low-market-access contexts less studied. While we cannot claim this is the "first" such study without a systematic review, it makes a significant contribution to understanding implementation in remote contexts.
2. **Methodological contribution:** It demonstrates the value of mixed-methods research for understanding implementation processes the qualitative data reveal the mechanisms underlying quantitative patterns, providing insights that quantitative data alone cannot capture (Creswell & Poth, 2018; Creswell & Plano Clark, 2018).
3. **Mediation analysis:** It identifies the specific mediating factors gender, geographic location, cooperative membership that shape implementation outcomes, providing evidence that can inform the design of future agricultural support programmes to address the unique challenges facing remote and vulnerable households.
4. **Theoretical contribution:** It operationalises Sen's Entitlement Theory and the Sustainable Livelihoods Framework to explain implementation failures, demonstrating the value of this integrated framework for understanding agricultural support programmes.
5. **Policy contribution:** It provides specific, actionable evidence for agricultural support programme design based on empirical evidence from a context that has been largely excluded from policy discussions.

5.6 Limitations

This study has several limitations:

1. **Cross-sectional design:** The cross-sectional design captures a single point in time, limiting causal inference about long-term implementation patterns (Field, 2024; Groves et al., 2022). The associations reported should be interpreted as correlational rather than

causal. Implementation patterns may vary across seasons and policy cycles, particularly in election years when political interference may be more pronounced.

2. **Single-site focus:** The single-site focus on Kawimbe limits generalisability to other contexts. However, thick description enables readers to assess transferability to similar contexts (Lincoln & Guba, 1985; Kumar et al., 2025). Future research should examine multiple sites across different agro-ecological zones to assess the generalisability of findings.
3. **Sample size:** The final sample of 300 households is slightly below the calculated minimum of 307. This shortfall of 7 households (2.3%) is unlikely to substantially affect statistical power, but it is acknowledged as a limitation. The decision to maintain equal sample sizes for beneficiaries and non-beneficiaries (150 each) facilitated statistical comparison but meant that the overall sample was slightly smaller than initially planned.
4. **Self-report data:** Reliance on self-reported data is subject to recall and social desirability bias, though triangulation with secondary data and qualitative accounts helps mitigate this (Groves et al., 2022). Future research should consider using administrative data such as voucher redemption records to validate self-reports.
5. **Modest sample of female-headed households:** The modest sample of female-headed households 50, representing 16.7% of the sample limits statistical power for subgroup analyses, though this is mitigated through qualitative exploration (Doss & Quisumbing, 2024).
6. **Measurement of food security:** The study used self-reported food security measures (HFIAS, HDDS, MAHFP), which capture food access but not dietary quality or nutritional outcomes. Future research should consider incorporating anthropometric measures or dietary diversity assessments.
7. **Seasonal variation:** The study was conducted in a single agricultural season. Future research should examine how implementation patterns vary across seasons and how this affects household food security.
8. **Mediation analysis limitations:** The mediation analysis assumes that the causal ordering of variables is correctly specified FISP participation → mediators → food security. While this ordering is theoretically justified, the cross-sectional design cannot definitively establish causal direction. The mediation results should be interpreted as suggestive rather than definitive.
9. **Sampling design:** While the study used stratified random sampling, the analysis did not fully account for the complex sampling design in all analyses. Future analyses should use appropriate survey estimation procedures to account for stratification and clustering.

5.7 Policy Implications for Agricultural Support Programme Design

Based on the findings, the following policy implications for agricultural support programme design emerge. These recommendations are presented as implications of the evidence rather than as proof that particular interventions will produce better outcomes:

1. **Decentralised logistics:** Agricultural support programmes should consider decentralising input delivery to district level, allowing for context-specific planning and implementation. This could help reduce the logistical bottlenecks that cause delays in remote areas.
2. **Multiple delivery channels:** Programmes should maintain multiple delivery channels digital and paper vouchers, direct distribution to address connectivity gaps and ensure access for all households.
3. **Mobile distribution points:** Programmes should consider establishing mobile distribution points for remote communities, which could reduce the "proximity penalty" and transport costs for far zone households.
4. **Gender-sensitive targeting:** Programmes should adopt gender-sensitive targeting with quotas for female beneficiaries, ensure vouchers are registered in women's names, and provide targeted support to female-headed households.
5. **Strengthened cooperative structures:** Programmes should strengthen cooperative structures through training, capacity building, and support for collective input procurement and marketing.
6. **Investment in extension:** Programmes should invest significantly in extension services, including increasing the number of extension agents, providing them with transport and supplies, and expanding farmer-to-farmer extension approaches.
7. **Agro-dealer capacity:** Programmes should strengthen agro-dealer capacity through timely reimbursement, credit access, and training to ensure adequate stock in remote areas.
8. **Community oversight:** Programmes should establish community oversight mechanisms to reduce elite capture and political interference, ensuring that benefits reach the most vulnerable households.
9. **Rural infrastructure investment:** Programmes should advocate for investment in rural infrastructure roads, electricity, network coverage to address the underlying physical capital constraints that mediate programme effectiveness.
10. **Graduation strategy:** Programmes should develop a clear graduation strategy to enhance the sustainability of gains for farmers who exit the programme (Parliament of Zambia, 2023).
11. **Pilot testing:** Given the complexity of implementation challenges, new programme designs should be pilot-tested in diverse contexts before national rollout to identify and address context-specific barriers.

6. Conclusion

This article has examined FISP implementation processes and mediating factors in Kawimbe, Mbala District, Northern Province, generating evidence relevant to ongoing policy discussions about agricultural support reform. The findings reveal pervasive implementation failures chronic delays, e-voucher functionality challenges, gender disparities, and geographic inequities that reflect systemic transfer entitlement failures (Sen, 1981; Devereux, 2022). These failures disproportionately affect remote and female-headed households, undermining programme effectiveness and equity.

The study makes several important contributions:

1. **Empirical contribution:** It provides an in-depth analysis of FISP implementation processes in Northern Province, addressing a geographical gap in the literature.
2. **Theoretical contribution:** It demonstrates the value of integrating Sen's Entitlement Theory, the Sustainable Livelihoods Framework, and the Capability Approach for understanding implementation failures and mediating factors in agricultural support programmes.
3. **Methodological contribution:** It demonstrates the value of sequential explanatory mixed-methods design for understanding implementation processes, with mediation analysis identifying specific pathways through which programme participation is associated with food security.
4. **Policy contribution:** It provides specific, actionable evidence for agricultural support programme design, including decentralised logistics, multiple delivery channels, gender-sensitive targeting, mobile distribution points, strengthened cooperative structures, and investment in extension and rural infrastructure

Key findings include:

- I. Only 34.0% of beneficiaries received inputs on time, with far zone households experiencing mean delays of 5.1 weeks.
- II. Female-headed households comprised only 14.0% of beneficiaries and were nearly three times more likely to experience late delivery (AOR=2.84, $p=0.006$).
- III. Each additional kilometre from the agro-dealer was associated with 15% higher odds of late delivery (AOR=1.15, $p=0.003$).
- IV. Cooperative membership was protective against late delivery (AOR=0.42, $p=0.014$).
- V. FISP beneficiaries had significantly better food security outcomes than non-beneficiaries (HFIAS: 8.42 vs 10.55, $p=0.002$).

- VI. Female-headed and far zone beneficiaries had significantly worse food security outcomes than their counterparts.
- VII. Mediation analysis revealed that input timeliness, gender of household head, distance to agro-dealer, and cooperative membership significantly mediated the relationship between FISP participation and household food security.
- VIII. Qualitative analysis revealed five major themes: "The Digital Entitlement Gap," "The Proximity Penalty," "Gendered Exclusion," "Elite Capture and Political Interference," and "The Timeliness-Yield Connection."

The transition from FISP to CASP, or other reforms to agricultural support, presents a critical opportunity to redesign agricultural support based on evidence from two decades of implementation. Addressing the implementation failures and mediating factors identified in this study is essential for ensuring that agricultural support programmes achieve their intended food security outcomes in remote rural contexts. Without such redesign, future programmes risk perpetuating the systemic exclusion and inequities that have undermined FISP's effectiveness, particularly for the most vulnerable households.

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9. Conflicts of Interest

The authors declare no conflicts of interest.

10. Data Availability Statement

The data presented in this study are available on request from the corresponding author. Due to ethical considerations and participant confidentiality, the full dataset cannot be made publicly available but can be accessed for verification purposes upon reasonable request to the corresponding author. The qualitative transcripts cannot be shared due to the risk of identifying individual participants, but summaries and coded extracts are available upon request.

11. List of Abbreviations

Abbreviation	Full Form
AOR	Adjusted Odds Ratio
ARUREC	Africa Research University Research Ethical Committee
CASP	Comprehensive Agriculture Support Programme
CI	Confidence Interval
DACO	District Agricultural Coordinator
DFID	Department for International Development
FGD	Focus Group Discussion
FISP	Farmer Input Support Programme
HDDS	Household Dietary Diversity Score
HFIAS	Household Food Insecurity Access Scale
KII	Key Informant Interview
MAHFP	Months of Adequate Household Food Provisioning
NHRA	National Health Research Authority
SD	Standard Deviation
SLF	Sustainable Livelihoods Framework
VIF	Variance Inflation Factor
ZIAMIS	Zambia Integrated Agriculture Management Information System

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