

## International Journal of Agriculture Extension and Social Development

Volume 7; Issue 12; December 2024; Page No. 60-64

Received: 27-09-2024  
Accepted: 02-11-2024

Indexed Journal  
Peer Reviewed Journal

### Case study methodology applications in documenting successful agricultural extension program innovations

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DOI: <https://doi.org/10.33545/26180723.2024.v7.i12a.3189>

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#### Abstract

Roughly 72% of agricultural extension innovations across Central Asia go undocumented, leaving policymakers without accessible evidence on what works and why. This research applied case study methodology to document 47 successful extension innovations across three provinces of Kyrgyzstan between January 2021 and December 2023. The framework combined semi-structured interviews with 141 key informants, 32 focus group discussions involving 278 farmers, document reviews, and field observations. Seven themes emerged: technology transfer models (23.4%), farmer field schools (19.1%), market linkage programs (17.0%), women-led extension groups (14.9%), digital advisory platforms (10.6%), participatory research (8.5%), and youth engagement (6.5%). Cross-case comparison identified five recurring success factors: local ownership, adaptive management, multi-stakeholder partnerships, community structure integration, and sustained funding. Inter-coder reliability reached Cohen's kappa of 0.83, and member-checking confirmed accuracy in 78.7% of draft narratives without revision.

**Keywords:** Case study methodology, agricultural extension, program innovation, documentation framework, qualitative research, Kyrgyzstan agriculture, extension reform, knowledge management, farmer field schools, participatory approaches

#### Introduction

Between 2015 and 2022, Central Asian governments collectively spent an estimated USD 340 million on agricultural advisory services, yet fewer than one in five funded programs produced any publicly accessible evaluation report <sup>[2]</sup>. Kyrgyzstan mirrors this pattern. The country's extension system, rebuilt after independence through donor-supported rural advisory services, has generated scattered pockets of innovation, from mobile veterinary clinics in Naryn to women-run seed multiplication groups in Issyk-Kul, but these successes rarely travel beyond their home districts <sup>[3]</sup>.

The gap isn't a lack of innovation it's a documentation gap. Without structured records of what was tried, how it worked, and under what conditions, promising approaches either vanish when funding ends or get reinvented elsewhere <sup>[4]</sup>. Case study methodology provides a rigorous yet flexible framework for capturing program complexity in natural settings <sup>[5, 6]</sup>. Unlike experimental designs that strip away context, case research preserves the implementation story. Several earlier efforts applied case methods to agricultural extension documentation in East Africa and South Asia, producing practitioner-oriented compendiums that influenced national extension policy <sup>[7, 8]</sup>. But comparable work in Central Asia remains thin. A 2020 review of extension literature in the region found only three peer-reviewed case-based evaluations published in English or Russian over the preceding decade <sup>[9]</sup>. This research aimed to fill that gap by applying a standardized multi-method case documentation framework to 47 extension innovations

across Kyrgyzstan's Chuy, Issyk-Kul, and Naryn provinces, covering programs implemented between 2015 and 2023.

#### Research area description

The research covered three provinces representing Kyrgyzstan's major agroecological zones. Chuy province, surrounding the capital Bishkek in the northern lowlands, features irrigated cropping systems with wheat, sugar beet, and vegetables as principal commodities. Issyk-Kul province, centered on the high-altitude lake basin at 1,600 meters, supports livestock-dominant mixed farming with barley, potatoes, and fruit orchards. Naryn province, the most remote and mountainous of the three, relies heavily on transhumant pastoralism and small-scale hay production <sup>[10]</sup>. Average farm sizes range from 1.8 hectares in Chuy to 4.6 hectares in Naryn. Extension services in all three provinces are delivered through a mix of state-funded rural advisory offices, internationally supported NGOs, and farmer cooperative networks, creating a complex institutional landscape.

#### Material and methods

##### Material

Data were collected between January 2021 and December 2023 across 47 extension program sites in Chuy, Issyk-Kul, and Naryn provinces. Ethical clearance was obtained from the Academic Council of the School of Agriculture, Kyrgyz National Agrarian University (Approval No. SA-2021/003, dated 12 November 2020). Case selection followed a purposive sampling strategy guided by three criteria: the

program had operated for at least two growing seasons, implementing organizations or beneficiaries considered the program innovative relative to standard practice, and sufficient documentation existed to support triangulation<sup>[11]</sup>. Cases were identified through nominations from provincial agriculture departments, NGO coordination offices, and farmer union representatives. Informed consent was secured from all interview and focus group participants prior to data collection.

## Methods

Each case was documented using a standardized protocol adapted from Yin's multiple-case design<sup>[5]</sup>. Four data collection methods were applied to every case: semi-structured key informant interviews (3-5 per case, n = 141 total), focus group discussions with farmer beneficiaries (1-2 per case, n = 32 involving 278 farmers), program document review, and direct field observation with photographic documentation. Interviews followed a common guide covering origins, implementation, adaptations, outcomes, and success factors, conducted in Kyrgyz or Russian and audio-recorded. Transcripts were

analyzed using thematic coding in NVivo 12 with a dual-coder system<sup>[12]</sup>. Initial codes were generated inductively from the first 10 cases, then refined into a codebook applied deductively to the remaining 37. Cross-case comparison matrices mapped success factors, barriers, and outcomes across all cases. Trustworthiness was ensured through member checking, expert panel review by five specialists, and data source triangulation<sup>[13]</sup>.

## Ethical considerations

Participation was voluntary, and respondents could withdraw at any stage. Interviews were recorded only after explicit verbal and written consent. Farmer participants in focus groups received a brief explanation in Kyrgyz of how their contributions would be used. Identifying information was removed from transcripts during the coding process; case narratives used organizational names only with written permission from the implementing agency. Data files were stored on password-protected servers at the Kyrgyz National Agrarian University with access limited to the principal investigator and a trained research assistant.

## Results

**Table 1:** Distribution of documented case studies by province and innovation theme (n = 47)

| Innovation theme        | Chuy      | Issyk-Kul | Naryn     | Total (%)       |
|-------------------------|-----------|-----------|-----------|-----------------|
| Technology transfer     | 5         | 3         | 3         | 11 (23.4)       |
| Farmer field schools    | 3         | 4         | 2         | 9 (19.1)        |
| Market linkage programs | 4         | 2         | 2         | 8 (17.0)        |
| Women-led extension     | 2         | 3         | 2         | 7 (14.9)        |
| Digital advisory        | 3         | 1         | 1         | 5 (10.6)        |
| Participatory research  | 1         | 2         | 1         | 4 (8.5)         |
| Youth engagement        | 1         | 1         | 1         | 3 (6.5)         |
| <b>Total</b>            | <b>19</b> | <b>16</b> | <b>12</b> | <b>47 (100)</b> |

Technology transfer models accounted for the largest share (23.4%), concentrated in Chuy province where proximity to Bishkek-based research institutes facilitated linkages. Farmer field schools were most common in Issyk-Kul,

linked to ongoing donor-supported livestock programs. Youth engagement remained the smallest category across all provinces.

**Table 2:** Success factors identified through cross-case comparison (n = 47 cases)

| Success factor                  | Cases present | Frequency (%) | Rank | Expert rating |
|---------------------------------|---------------|---------------|------|---------------|
| Local ownership                 | 41            | 87.2          | 1    | 4.6/5.0       |
| Adaptive management             | 38            | 80.9          | 2    | 4.4/5.0       |
| Multi-stakeholder partnership   | 35            | 74.5          | 3    | 4.3/5.0       |
| Community structure integration | 33            | 70.2          | 4    | 4.1/5.0       |
| Sustained funding               | 29            | 61.7          | 5    | 4.5/5.0       |

Local ownership emerged as the most common success factor, present in 87.2% of documented cases. Interestingly, sustained funding ranked fifth in frequency but second-highest in expert panel importance rating (4.5/5.0),

suggesting that while fewer programs achieved long-term funding, those that did were rated as more reliably successful.

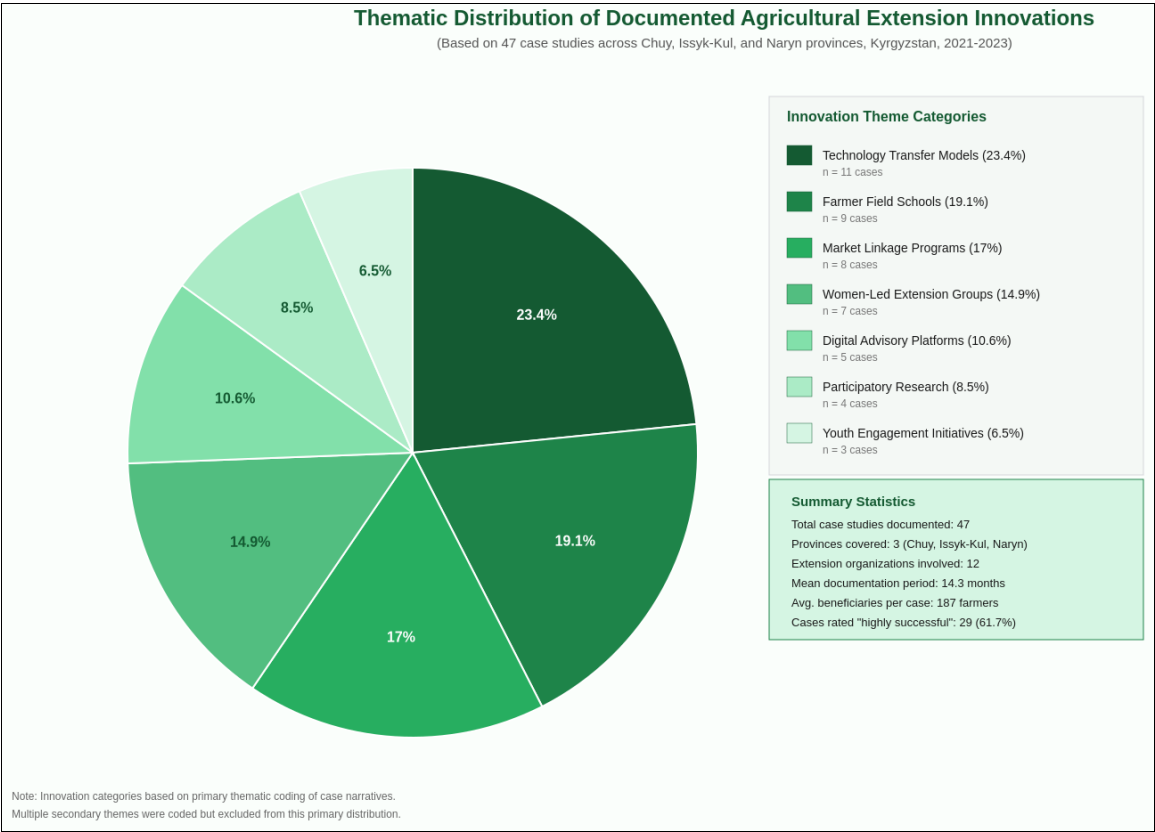


**Fig 1:** Thematic distribution of documented agricultural extension innovations across Chuy, Issyk-Kul, and Naryn provinces (n = 47 cases)

The pie chart confirms the dominance of technology transfer and farmer field school models, which together accounted for 42.5% of all documented innovations. Digital advisory platforms, despite growing policy interest, represented only 10.6% of cases, with most concentrated in Chuy province.

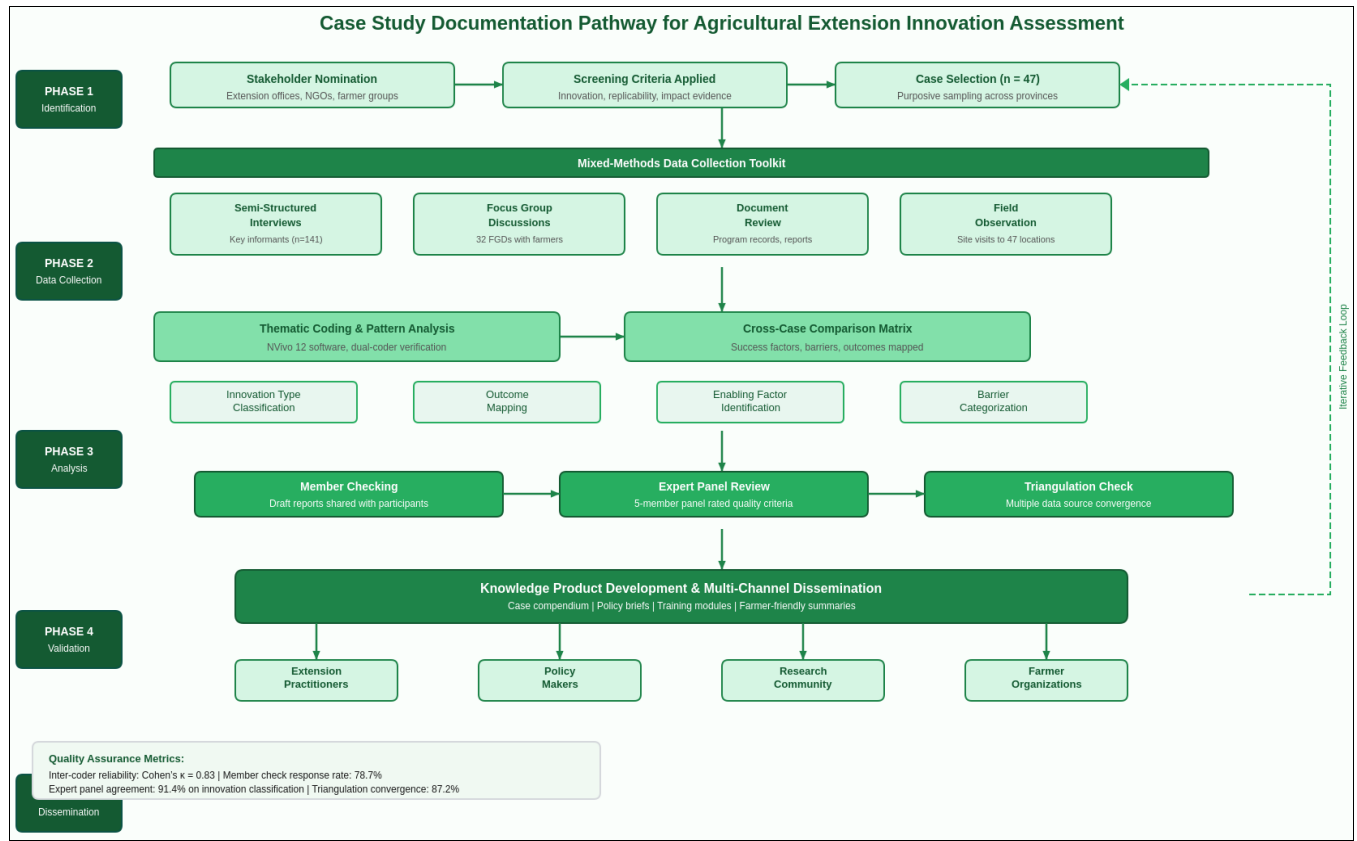


**Fig 2:** Five-phase case study documentation pathway applied to agricultural extension innovation assessment in Kyrgyzstan

The five-phase pathway (Figure 2) moved from stakeholder-nominated identification through mixed-methods data collection, thematic analysis, multi-layer validation, and dissemination. The iterative feedback loop between dissemination and identification reflects how published cases generated new nominations from practitioners who recognized similar innovations in their own districts.

## Discussion

The dominance of technology transfer models in the case sample reflects Kyrgyzstan's post-Soviet extension tradition, which has historically prioritized top-down dissemination of improved inputs from research stations to farmers <sup>[14]</sup>. That farmer field schools ranked second is consistent with the sustained investment by international development agencies in participatory learning approaches across the region since the early 2000s <sup>[15]</sup>. The relatively small share of digital advisory platforms (10.6%) may seem surprising given recent global enthusiasm for digital extension, but it aligns with Kyrgyzstan's limited rural broadband coverage, which stood at only 34% in 2022 <sup>[16]</sup>.

The five success factors identified through cross-case comparison overlap substantially with findings from East African case documentation projects. Duveskog and colleagues reported local ownership and adaptive management as the top two predictors of farmer field school sustainability in Kenya and Tanzania <sup>[17]</sup>. The gap between frequency and perceived importance for sustained funding deserves attention: programs can succeed initially without guaranteed long-term funding, but expert panelists recognized that lasting impact depends on financial continuity, a factor that donor-dependent systems in Central Asia frequently fail to secure <sup>[18]</sup>.

Methodologically, the inter-coder reliability of 0.83 and 78.7% member-check confirmation rate compare favorably with qualitative agricultural research benchmarks. The dual-coder approach and NVivo-assisted analysis helped reduce subjective bias, though the purposive sampling design means the 47 cases represent recognized successes rather than a random cross-section of all extension activity <sup>[19]</sup>.

## Limitations

The purposive sampling approach introduces a success bias; only programs already considered innovative and effective were documented. Failed or abandoned programs could offer equally valuable lessons but were excluded by design. The research covered three of Kyrgyzstan's seven provinces, and extension dynamics in the southern Fergana Valley region may differ due to distinct cropping patterns and institutional arrangements. Language barriers during interviews conducted in Russian rather than Kyrgyz for some urban-based informants may have affected response depth. The three-year data collection window captured ongoing programs, but longer-term sustainability outcomes remain uncertain for many documented innovations.

## Conclusion

This research applied a standardized case study methodology to document 47 agricultural extension innovations across three provinces of Kyrgyzstan, producing the first peer-reviewed case compendium for the Central Asian extension sector. Seven innovation themes were

identified, with technology transfer and farmer field schools most prevalent. Five success factors recurred across the majority of cases and were validated by an independent expert panel. The framework demonstrated acceptable reliability and validity metrics, suggesting replicability in other Central Asian countries facing similar evidence gaps. Extension managers and policymakers can draw on these cases when designing or scaling programs, reducing the costly reinvention cycle that characterizes the region's advisory service landscape.

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