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Process evaluation of extension delivery mechanisms for identifying implementation bottlenecks and solutions

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Abstract

Extension programs across Iraq's central agricultural belt reach thousands of farmers each season, yet many fail to produce lasting changes in farming practice. The problem is rarely the message itself -it is what breaks down between program design and field delivery. This research conducted a process evaluation of six extension delivery mechanisms operating in four governorates of central Iraq to identify implementation bottlenecks and propose corrective solutions. Data were gathered from 224 farmers and 38 extension staff through structured surveys, supplemented by direct observation of 42 extension events between January and September 2023. Resource mobilization emerged as the most severe bottleneck stage (mean severity 3.4/5.0 across mechanisms), with 71.4% of programs experiencing budget delays that disrupted delivery schedules. Radio advisory programs showed the weakest feedback collection (severity 4.2/5.0), while farm visits scored best on implementation quality but worst on monitoring. The research mapped three critical bottleneck points along the delivery pipeline and matched each with evidence-based solutions including participatory needs assessment, advance resource allocation, and real-time monitoring tools. These findings provide extension managers with a diagnostic lens for identifying where programs stall and practical options for keeping delivery on track.

Keywords: Process evaluation, extension delivery, implementation bottlenecks, agricultural extension, delivery mechanisms, farmer field schools, monitoring and evaluation, resource allocation, advisory services

Introduction

A recurring frustration for extension managers in Iraq is watching well-designed programs fall apart during implementation. Seeds arrive after planting season, demonstration plots are established without follow-up visits, and farmer field school sessions shrink from twelve weeks to four because budgets run out mid-cycle ^[1]. These are not design failures -they are process failures, and they demand process-level evaluation to diagnose and fix ^[2].

Most extension evaluations focus on outcomes: did farmers adopt the practice, did yields increase, did incomes improve? While outcome evaluation is important, it cannot explain why a program worked in one district but failed in another when the same design was used in both ^[3]. Process evaluation fills this gap by examining the internal workings of program delivery -how resources were mobilized, whether activities happened as planned, and where breakdowns occurred along the implementation chain ^[4].

Iraq's extension system, managed through the Ministry of Agriculture's regional directorates, delivers advisory services through a mix of mechanisms including farm visits, demonstration plots, farmer field schools, radio broadcasts, mobile advisory messages, and group meetings ^[5]. Each mechanism has a different delivery pipeline and different vulnerability points. But systematic comparison of bottleneck patterns across mechanisms has not been attempted in the Iraqi context ^[6].

This research applied a process evaluation framework to six delivery mechanisms operating across four governorates of central Iraq. The objectives were

- Mapping the delivery pipeline for each mechanism,
- Measuring bottleneck severity at each pipeline stage, and
- Identifying practical solutions matched to the most critical bottlenecks.

The goal was to give extension managers a diagnostic tool rather than another list of outcomes.

Study area description

The research covered four governorates in central Iraq: Baghdad, Babil, Wasit, and Diyala. These governorates sit within the fertile alluvial plain between the Tigris and Euphrates rivers, supporting irrigated agriculture of wheat, barley, rice, and date palms. Average annual rainfall ranges from 100 to 250 mm, making irrigation essential for crop production. The four governorates collectively have approximately 340 extension staff serving over 600,000 farming households. Extension activities operate under challenging conditions including periodic security disruptions, infrastructure damage from past conflicts, and chronic budget shortfalls.

Material and Methods

Material

Data were collected from 224 farmers who had participated

in at least one extension activity during the 2022-2023 agricultural season, selected through stratified random sampling from extension participation records. An additional 38 extension staff (field officers and supervisors) were surveyed. Structured questionnaires measured bottleneck severity across five delivery stages (planning, resource mobilization, implementation, monitoring, and feedback) on a five-point scale. Direct observation of 42 extension events (seven per mechanism) used a standardized checklist with 18 process quality indicators. All data were collected between January and September 2023. Ethical approval was granted by the University of Baghdad College of Agriculture Research Committee (Protocol UB-CA-2023-017, December 2022).

Methods

Bottleneck severity scores were aggregated by mechanism and stage. Heatmap visualization displayed patterns of

severity across the mechanism-stage matrix. Descriptive statistics summarized farmer and staff responses. Observation checklist scores were converted to compliance percentages for each mechanism. Solutions were identified through triangulation of survey data, observation findings, and a focus group discussion with 14 experienced extension managers. Data analysis used SPSS 28.

Ethical considerations

Written informed consent was obtained from all participants in Arabic. Farmers were assured that responses would not affect their access to extension services. Extension staff were informed that individual responses would remain confidential and would not be shared with supervisors. Observation of extension events was conducted with prior consent from both the delivering officer and attending farmers. All data were anonymized and stored on password-protected university servers.

Results

Table 1: Mean bottleneck severity scores by delivery mechanism and stage (1-5 scale)

Mechanism	Plan.	Resource	Impl.	Monitor.	Feedback	Mean
Farm visits	2.1	3.4	1.8	3.7	3.9	2.98
Demo. plots	3.2	3.8	2.4	2.9	3.1	3.08
Farmer field schools	2.8	4.1	2.1	3.3	3.6	3.18
Radio programs	1.6	2.3	1.9	3.8	4.2	2.76
Mobile advisory	3.9	2.7	3.4	2.1	2.8	2.98
Group meetings	1.4	2.9	1.7	3.2	3.5	2.54

Farmer field schools had the highest overall bottleneck severity (3.18), driven largely by resource mobilization difficulties (4.1). Radio programs scored worst on feedback

(4.2) but had low planning bottlenecks (1.6). Group meetings showed the lowest overall severity (2.54).

Table 2: Observation checklist compliance by mechanism (n = 42 events)

Mechanism	Events (n)	Compliance (%)	SD
Farm visits	7	68.3	11.4
Demonstration plots	7	54.7	14.8
Farmer field schools	7	49.2	16.3
Radio programs	7	72.6	8.7
Mobile advisory	7	61.9	12.1
Group meetings	7	74.1	9.6

Group meetings showed the highest process compliance (74.1%), followed by radio programs (72.6%). Farmer field

schools had the lowest compliance (49.2%), mainly due to shortened session schedules and missing teaching materials.

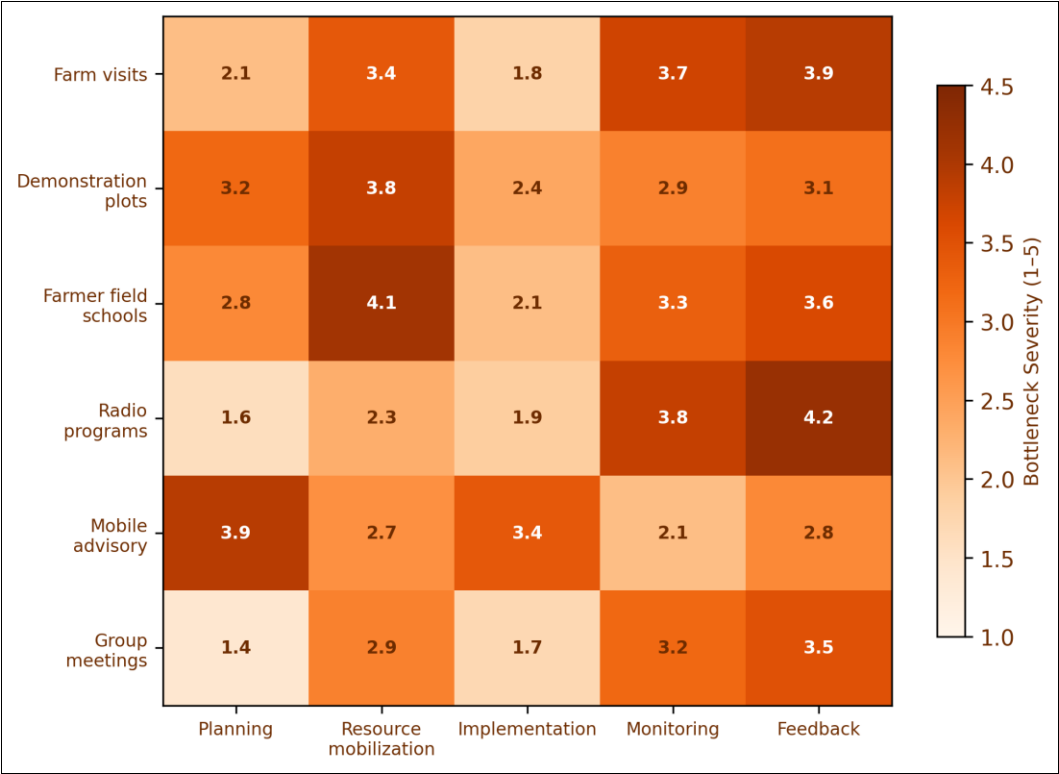


Figure 1. Heatmap of bottleneck severity across delivery mechanisms and pipeline stages

Darker cells indicate higher severity. Resource mobilization and feedback stages consistently show the highest bottleneck levels across most mechanisms. The heatmap

allows managers to quickly identify which mechanism-stage combinations require the most urgent attention.

Extension Delivery Pipeline: Key Bottleneck Points

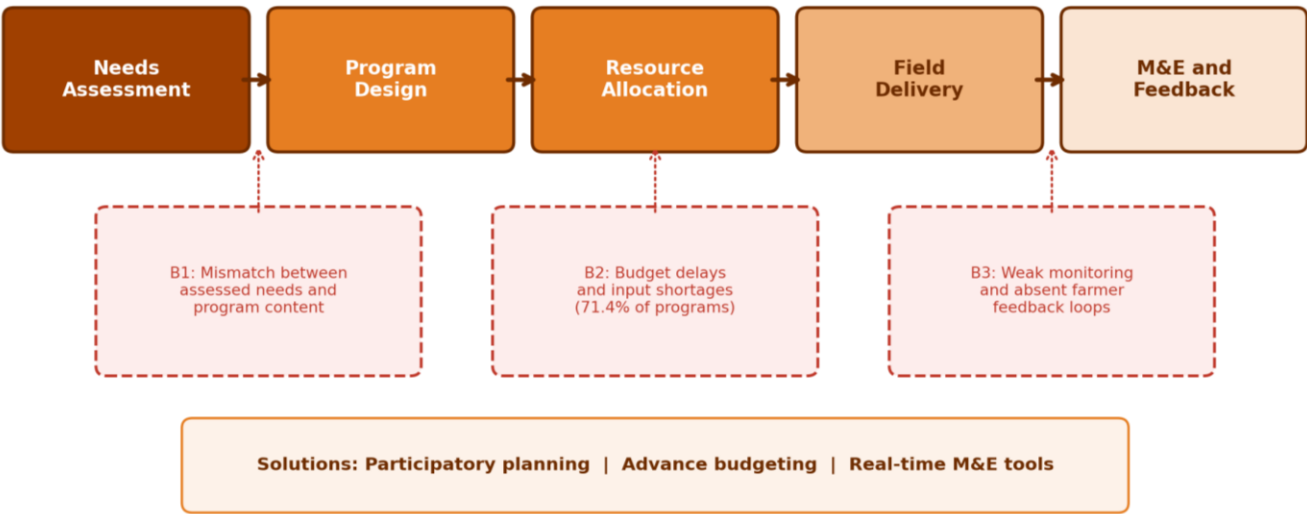


Figure 2: Extension delivery pipeline with critical bottleneck points and proposed solutions

Three bottleneck points were mapped along the pipeline: a design-needs mismatch between assessment and program design, budget delays at resource allocation, and weak monitoring and feedback at program closure. Each bottleneck is paired with a targeted solution at the bottom of the diagram.

Discussion

The dominance of resource mobilization as a bottleneck stage is consistent with reports from other resource-constrained extension systems in the Middle East and North Africa [7, 8]. When budgets arrive late or inputs are insufficient, even well-planned programs lose momentum.

Farmer field schools were especially vulnerable because they depend on sustained inputs across a full growing season -any interruption causes cascading delays^[9].

The weak feedback scores across most mechanisms confirm a pattern seen in many extension systems: delivery is treated as a linear push of information rather than a cycle that includes farmer response^[10]. Radio programs scored worst on feedback not because the medium is inherently one-directional -call-in segments exist -but because no systematic mechanism captured and routed listener responses back to program planners^[11].

The observation data added an important dimension that surveys alone could not capture. Farmer field school compliance at 49.2% was lower than what staff self-reported, suggesting that bottleneck severity may actually be underestimated in survey-only evaluations. This supports the argument that process evaluation should combine participant perceptions with direct observation wherever feasible^[4]. The diagnostic pipeline model offers extension managers a practical tool for locating failures before they compound into outcome-level problems. Rather than waiting for end-of-season evaluations to discover that a program didn't work, managers can monitor bottleneck indicators throughout the delivery cycle^[12].

Practical applications

Extension managers should conduct quarterly bottleneck assessments using the severity rating tool tested in this research. Budget delays can be mitigated by establishing advance procurement agreements with input suppliers before program launch. Feedback mechanisms should be built into every delivery mechanism by default, not added as optional extras. For farmer field schools, contingency budgets of at least 15% above planned costs would buffer against mid-season disruptions that currently cause the highest dropout rates among participants.

Conclusion

This research demonstrated that implementation bottlenecks in Iraq's extension delivery system are concentrated at two points: resource mobilization and feedback collection. These bottlenecks affect all six mechanisms examined, though their severity varies. Farmer field schools and demonstration plots were most vulnerable due to their dependence on sustained resource flows, while radio programs and group meetings showed higher process compliance but weaker feedback integration.

The pipeline model and bottleneck heatmap offer extension managers tangible diagnostic tools that shift attention from asking whether programs worked to asking where programs broke down. This distinction matters because it points to fixable process failures rather than broad judgments of program success or failure. Extension organizations should embed process monitoring into routine operations rather than reserving evaluation for end-of-cycle reviews. Doing so allows corrective action while programs are still running, which is when it can actually make a difference to farmers waiting for advice they were promised.

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