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Women's empowerment index construction for evaluating gender outcomes of agricultural extension programs

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Abstract

Empowerment, as applied to women in agriculture, refers to the expansion of agency, resources, and achievements that allow women to make strategic life choices—yet most extension evaluations still measure it through simple participation counts. This research developed and validated a Women's Empowerment Index (WEI) tailored to agricultural extension contexts, then applied it to evaluate gender outcomes across three extension program types involving 264 women farmers in Tehran and Isfahan Provinces, Iran. A six-step construction process was followed from March to November 2022, yielding a 42-indicator index across five domains: production decisions, resource access, income control, community leadership, and time allocation. Confirmatory factor analysis showed acceptable model fit (CFI = 0.91, RMSEA = 0.058). Women in livestock-focused extension programs scored highest on the WEI (mean = 0.61) compared to crop-focused (0.52), mixed programs (0.57), and non-participants (0.38). The resource access domain showed the largest gap between participants and non-participants. This index offers extension agencies a standardized, field-tested tool for tracking gender-specific program outcomes beyond simple headcount metrics.

Keywords: Women's empowerment, gender index, agricultural extension, program evaluation, Iran, resource access, production decisions, gender outcomes, empowerment measurement, extension programs

Introduction

Empowerment, in the context of agricultural development, means more than giving women access to seeds or training; it means expanding their capacity to make decisions, control resources, and participate in community governance on equal terms ^[1]. This definition, while widely accepted in development theory, has proven remarkably difficult to operationalize in extension program evaluation. Most agencies still rely on participation rates and output counts to assess gender outcomes, measures that capture presence but not power ^[2].

The Women's Empowerment in Agriculture Index (WEAI) developed by Alkire *et al.* ^[3] represented a breakthrough by creating a multidimensional measure spanning production, resources, income, leadership, and time use. But the WEAI was designed for national-level monitoring, not for evaluating individual extension programs. Its 24-item structure requires adaptation for local contexts, and several researchers have noted cultural sensitivity gaps when applying it outside sub-Saharan Africa ^[4]. In Iran, where women contribute to 40–60% of agricultural labor but face distinct cultural and institutional constraints, no validated empowerment index exists for extension program evaluation ^[5].

This research aimed to construct and validate a context-specific Women's Empowerment Index for Iranian agricultural extension, then apply it to compare gender outcomes across three program types in Tehran and Isfahan Provinces ^[6].

Materials and Methods

Materials

This research was conducted through Tarbiat Modares University across Tehran (35.69°N, 51.39°E) and Isfahan (32.65°N, 51.67°E) Provinces from March to November 2022. A total of 264 women farmers were surveyed: 68 from crop-focused extension programs, 72 from livestock-focused programs, 65 from mixed programs, and 59 non-participants serving as a control group. Participants were selected through stratified random sampling from provincial extension office registers. The index construction followed a six-step process (Figure 2): literature review, domain identification, indicator selection, weight assignment through expert panels, field validation, and final computation. Ethical approval was obtained from the Tarbiat Modares University Research Ethics Committee (TMU-REC-2022-041, approved February 22, 2022).

Instrument Development

The WEI was constructed across five domains adapted from the WEAI framework ^[3]: production decisions (9 indicators), resource access (10 indicators), income control (8 indicators), community leadership (8 indicators), and time allocation (7 indicators). An initial pool of 63 indicators was reviewed by a panel of 12 experts (6 gender specialists and 6 extension scientists) using a two-round Delphi process. Indicators with content validity ratios below 0.56 were eliminated, yielding 42 final indicators. Domain weights were assigned through Analytic Hierarchy Process

(AHP) with the same expert panel. The instrument was pilot-tested with 35 women farmers in Alborz Province.

Methods

Data were analyzed using SPSS version 27 and AMOS version 24. Confirmatory factor analysis (CFA) tested the five-domain structure. Model fit was assessed through CFI, RMSEA, and chi-square/df ratio. Internal consistency was evaluated using Cronbach's alpha for each domain. One-way ANOVA compared WEI scores across the four groups with post-hoc Tukey tests. Independent samples t-tests compared domain-level scores between participants and non-participants. Effect sizes were reported as Cohen's d.

Significance was set at $p < 0.05$.

Ethical Considerations

Written informed consent was obtained from all participants in Farsi. Given the sensitivity of gender-related questions in the Iranian context, interviews were conducted by trained female enumerators in private settings. Participants could skip any question without penalty. All data were anonymized, and no individually identifiable information was shared with extension offices or family members.

Results

Table 1: WEI Domain Scores by Extension Program Type (n=264)

Domain	Crop (n=68)	Livestock (n=72)	Mixed (n=65)	Control (n=59)	F	p
Production decisions	0.56	0.64	0.59	0.34	18.7	<0.001
Resource access	0.48	0.59	0.53	0.29	24.3	<0.001
Income control	0.54	0.63	0.58	0.41	14.1	<0.001
Community leadership	0.47	0.56	0.52	0.37	9.8	<0.001
Time allocation	0.53	0.61	0.58	0.46	7.2	<0.001
Overall WEI	0.52	0.61	0.57	0.38	21.6	<0.001

All five domains showed significant differences across groups (Table 1). The resource access domain displayed the largest gap between extension participants and non-participants (0.48–0.59 vs 0.29, Cohen's $d = 1.12$).

Livestock-focused programs scored highest across all domains, with an overall WEI of 0.61 compared to 0.38 for non-participants.

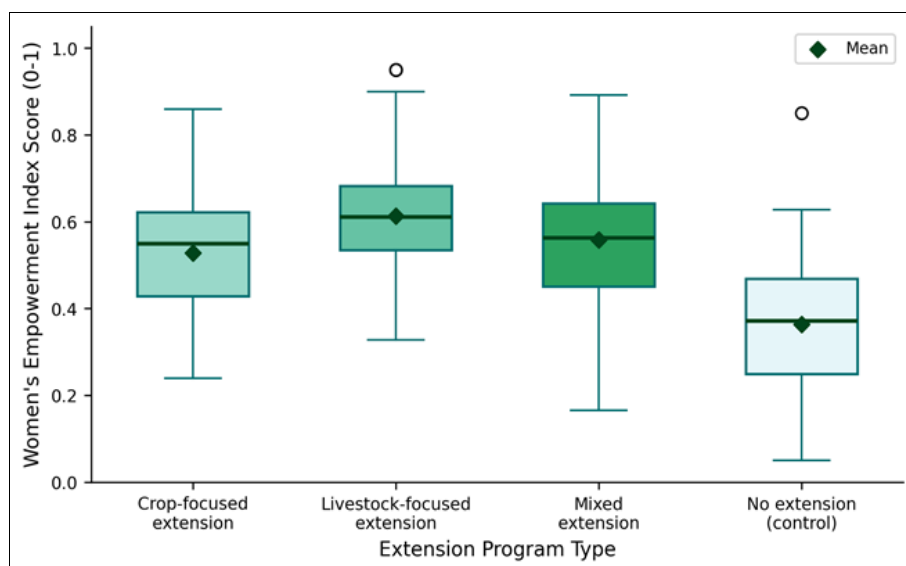


Fig 1: Distribution of Women's Empowerment Index scores by extension program type (n=264)

The box plot (Figure 1) reveals that the control group not only had a lower median but also greater score dispersion, suggesting that without extension support, empowerment

outcomes are highly variable and generally poor. The livestock group showed the tightest distribution around a higher median.

Table 2: CFA Model Fit Indices for the Five-Domain WEI Structure

Fit Index	Obtained Value	Threshold	Interpretation
Chi-square/df	2.14	< 3.0	Acceptable
CFI	0.91	> 0.90	Acceptable
RMSEA	0.058	< 0.08	Good
SRMR	0.064	< 0.08	Good
GFI	0.88	> 0.85	Acceptable

The CFA confirmed the five-domain structure with acceptable fit across all indices (Table 2). Cronbach's alpha ranged from 0.76 (time allocation) to 0.88 (resource access), indicating adequate internal consistency for all domains.

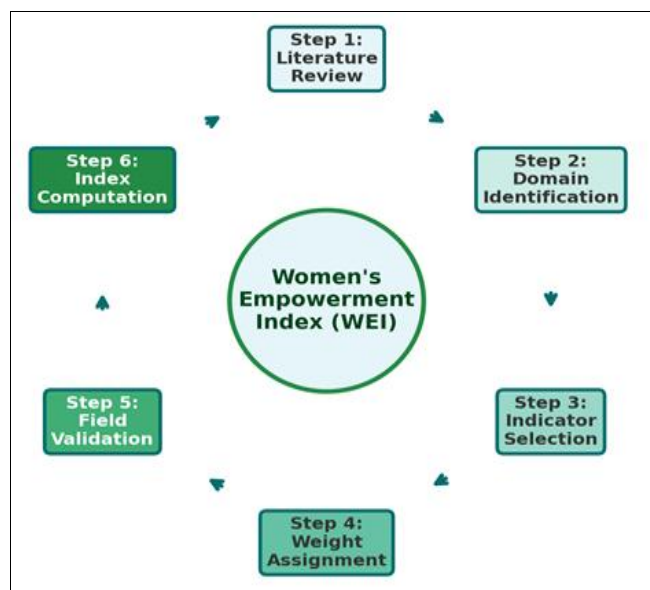


Fig 2: Six-step cycle for constructing the Women's Empowerment Index for agricultural extension evaluation

Discussion

The WEI captured empowerment differences that participation counts would miss entirely. All four groups had similar attendance rates in their respective programs, yet the index revealed a 0.23-point gap between the highest-scoring program type and non-participants a difference that translates into meaningful disparities in decision-making authority and resource control [7]. The finding that livestock programs produced the strongest empowerment scores may reflect the closer alignment between livestock management and women's existing responsibilities in Iranian rural households, where women traditionally manage small ruminants and poultry [8].

Resource access emerged as the domain with the largest participant/non-participant gap (Cohen's $d = 1.12$), suggesting that extension programs may be most effective at opening doors to inputs, credit, and land-use rights that women otherwise struggle to access independently [9]. The community leadership domain showed the smallest effect, consistent with Meinzen-Dick *et al.* [10] who found that leadership empowerment requires longer-term structural change beyond what extension programs typically deliver. The validated CFA model fit supports using this index as a standardized evaluation tool, though periodic re-validation is warranted as cultural contexts shift [11].

Practical Applications

Extension agencies in Iran and comparable Middle Eastern contexts can adopt this 42-indicator WEI as a routine evaluation instrument. The index should be administered at baseline and program completion to track empowerment changes over time. Programs showing weak performance in specific domains—particularly community leadership should consider adding targeted interventions such as women's cooperative formation and leadership training.

Conclusion

The Women's Empowerment Index constructed in this research provides a validated, multidimensional tool for measuring gender outcomes that simple participation metrics cannot capture. Extension programs that engage women in livestock management appear to generate the strongest empowerment effects, while resource access is the domain most responsive to extension intervention. The validated five-domain structure offers a replicable framework for extension agencies seeking to move beyond counting women participants toward measuring whether programs actually expand women's agency. For Iranian agricultural policy, these findings argue for mainstreaming empowerment measurement into extension evaluation protocols and designing programs that explicitly target the domains where women face the greatest constraints.

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