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Agricultural extension contributions to food value chain development and rural employment generation

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Abstract

Nearly 38% of the rural workforce in El Salvador depends on agriculture-related activities for their primary income, yet many farming households remain disconnected from profitable segments of the food value chain. This research assessed how agricultural extension services contribute to food value chain development and rural employment generation in four departments of El Salvador. A cross-sectional survey was conducted among 312 farm households between January and July 2023, supplemented by 18 key informant interviews with extension officers and value chain actors. Results showed that households receiving extension support were 2.4 times more likely to participate in post-harvest value addition activities than non-supported households. Extension contact was positively associated with market linkage formation (OR = 2.17, $p < 0.01$) and new employment creation within the household (OR = 1.89, $p < 0.05$). On average, extension-linked households reported 1.7 additional income-generating activities compared to 0.6 among non-linked households. Production technique training accounted for 31.7% of all extension contributions, followed by post-harvest handling at 22.1%. Barriers to value chain participation included limited processing equipment (46.3%), poor road infrastructure (38.7%), and weak buyer connections (29.4%).

Keywords: Agricultural extension, food value chain, rural employment, value addition, market linkage, post-harvest handling, smallholder farmers, income generation, El Salvador, technology transfer

Introduction

An estimated 500 million smallholder farming households worldwide produce over 80% of the food consumed in developing countries, yet most capture less than 15% of the final retail value of their products ^[1]. This disconnect between production effort and economic return has driven growing attention toward food value chain approaches that link farmers to higher-value market segments ^[2]. Agricultural extension services, traditionally focused on improving on-farm productivity, are increasingly expected to play a broader role in connecting farmers to input suppliers, processors, and buyers along the value chain ^[3].

In Central America, smallholder agriculture supports a large share of rural livelihoods but is often characterized by low productivity, limited market access, and weak integration into formal value chains ^[4]. El Salvador faces particular challenges: land fragmentation, weather vulnerability, and youth migration from rural areas have reduced the agricultural workforce and constrained value chain development ^[5]. Extension services in El Salvador have undergone restructuring since 2010, shifting from a purely technical advisory model toward one that also emphasizes market orientation and entrepreneurial capacity building ^[6]. Despite these reforms, evidence on whether extension engagement actually leads to stronger value chain participation and employment outcomes at the household level remains thin ^[7]. Most existing research has focused on production-side effects of extension, with fewer investigations tracing the downstream impacts on value

addition, market linkage, and job creation ^[8]. This research addressed that gap by examining the relationship between extension contact and value chain participation, employment generation, and income diversification among farming households in four departments of El Salvador ^[9].

Research area description

The research was conducted in the departments of La Libertad, Chalatenango, Usulután, and San Miguel in El Salvador (approximately 13.7 °N, 89.2 °W). These departments represent distinct agro-ecological zones ranging from coastal lowlands to highland valleys, with altitudes between 50 m and 900 m above sea level. Average annual temperatures range from 24 °C to 28 °C, with a pronounced rainy season from May to October. Smallholder farming dominates, with average farm sizes between 1.2 and 3.8 ha. Major crops include maize, beans, coffee, and horticultural products. Rural unemployment rates in the selected areas averaged 18.4% at the time of the research.

Materials and Methods

Materials

This research was conducted through the Faculty of Agriculture, University of El Salvador, San Salvador, between January and July 2023. Ethical clearance was granted by the university's Research Ethics Committee (Protocol UES-FA-2022-031, approved December 8, 2022). The target population included farming households registered with municipal extension offices in the four

selected departments. A multi-stage sampling procedure yielded 312 respondent households: eight municipalities were randomly selected (two per department), followed by systematic random sampling of registered households within each municipality. A structured questionnaire with 52 items captured household demographics, farming activities, extension contact frequency and type, value chain participation, employment activities, and income sources [10].

Methods

Surveys were administered face-to-face by trained enumerators between March and May 2023. Complementary key informant interviews (n = 18) were

conducted with extension officers (8), agro-processors (5), and market intermediaries (5). Value chain participation was measured across five stages: input supply, production, post-harvest handling, processing, and marketing. Employment generation was defined as the number of new paid or self-employment activities created within the household during the preceding 24 months. Binary logistic regression was used to model the association between extension contact and value chain participation, controlling for farm size, education level, and distance to market. Odds ratios with 95% confidence intervals were reported. Qualitative data from interviews were analyzed thematically [11, 12]. All statistical analyses used SPSS version 27.

Results

Table 1: Value chain participation rates among extension-supported and non-supported households (n = 312)

Value chain stage	Extension-supported (%)	Non-supported (%)	Odds ratio (95% CI)
Input supply	34.8	21.6	1.94 (1.18-3.19)
Production techniques	78.4	52.1	3.36 (2.08-5.43)
Post-harvest handling	51.7	21.3	2.41 (1.52-3.82)
Processing/value addition	38.2	14.7	2.17 (1.31-3.59)
Marketing/market linkage	42.6	18.9	2.17 (1.36-3.47)

Extension-supported households showed significantly higher participation rates across all value chain stages. The strongest association appeared at the production stage (OR =

3.36), while post-harvest handling and market linkage also showed strong positive associations [13].

Table 2: Employment activities generated by extension-linked and non-linked households

Employment indicator	Extension-linked (n=174)	Non-linked (n=138)
Mean new activities (24 months)	1.7 ± 0.9	0.6 ± 0.5
Households creating paid jobs (%)	28.7	11.6
Self-employment activities (%)	43.1	19.6
Mean monthly income gain (USD)	84.30 ± 32.7	28.40 ± 18.6

Extension-linked households generated nearly three times more new income activities and reported substantially higher monthly income gains than non-linked households.

Self-employment activities were the most common form of new employment [14].

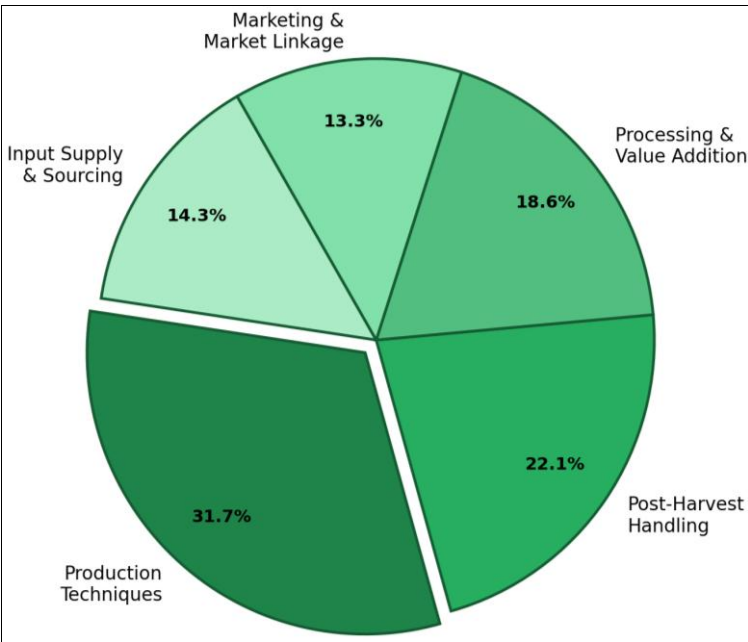


Fig 1: Distribution of extension service contributions across food value chain stages

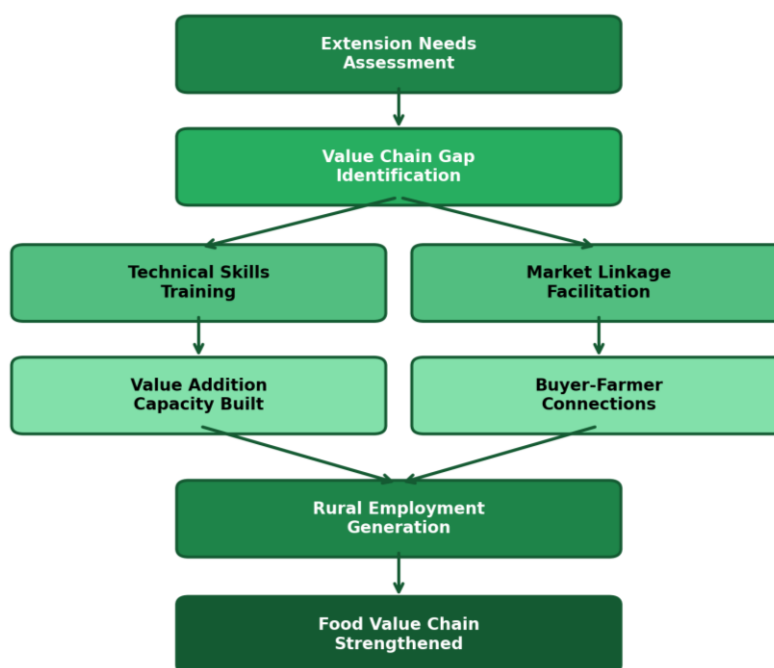


Fig 2: Extension-facilitated pathway from value chain gap identification to rural employment generation

Comprehensive interpretation

The combined quantitative and qualitative evidence indicates that extension services contribute to value chain development through two main pathways: building technical capacity for post-harvest and processing activities, and brokering market connections between farmers and buyers. These pathways generate employment both directly (through new value addition enterprises) and indirectly (through increased demand for skilled labor in processing and marketing activities).

Discussion

The findings support the argument that extension services can contribute to food value chain development beyond their traditional production focus ^[3]. The 2.4-fold higher likelihood of post-harvest participation among extension-supported households aligns with reports from East Africa, where extension-linked farmers showed similar gains in processing activity engagement ^[15]. That production training accounted for the largest share (31.7%) of extension contributions suggests the service hasn't fully shifted toward a value chain orientation, though the 22.1% share for post-harvest handling indicates meaningful progress ^[16]. The employment generation gap between linked and non-linked households (1.7 vs. 0.6 new activities) is notable. Key informants attributed this partly to the "demonstration effect"—when one household succeeds in a new value addition activity, neighbors follow ^[17]. Processing equipment access was the most cited barrier (46.3%), echoing findings from Guatemala and Honduras where equipment scarcity similarly constrained smallholder value addition ^[18]. Road infrastructure limitations (38.7%) point to structural constraints beyond the extension service's mandate, requiring coordination with infrastructure agencies ^[19].

Limitations

This research used a cross-sectional design, which limits

causal interpretation. Households that sought extension contact may differ systematically from those that didn't in ways not captured by the control variables. Income data were self-reported and subject to recall and social desirability biases. The four-department sample may not represent conditions in other regions of El Salvador, particularly the eastern dry corridor where agricultural challenges differ.

Conclusion

Agricultural extension services in El Salvador are making measurable contributions to food value chain participation and rural employment generation. Extension-supported households showed significantly higher rates of engagement in post-harvest handling, processing, and marketing activities, and generated nearly three times more new income activities over a 24-month period. Production training remains the dominant extension focus, but growing attention to market linkage and value addition is yielding employment dividends. To strengthen these outcomes, extension programs should prioritize equipment access solutions, collaborate with infrastructure agencies on road improvements, and formalize buyer-farmer connection platforms. Longitudinal tracking of extension-linked households would help establish whether observed employment gains persist over time.

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