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Socioeconomic and policy dimensions of sustainable food transitions among farming communities: An agricultural extension perspective

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Abstract

Sustainable food transitions are essential for ensuring climate resilience, environmental sustainability, and nutritional security in agrarian communities. This abstract deepens the discussion of how socioeconomic and policy factors influence the Sustainable Food Practice Index (SFPI) and Dietary Transition Index (DTI) in Kota district, Rajasthan. Using a structured survey of 300 farming households, this paper examines the roles of Education_Years, Farm_Size_ha, and Annual_Income—core indicators of Socioeconomic Status (SES)—along with policy awareness, institutional support, and agricultural extension contact. Findings indicate weak correlations between SES components and SFPI, suggesting that simply improving socioeconomic conditions is insufficient to drive sustainable adoption. Instead, farmers' uptake of sustainable practices depends on accessibility of resources, market incentives, perceived risk, and effectiveness of extension services. The expanded paper argues that strategic interventions must prioritize participatory extension models, targeted policy delivery, and climate-resilient value chains.

Keywords: Sustainable food transitions, socioeconomic status, policy factors

Introduction

The transition toward sustainable food systems represents a holistic transformation encompassing climatic, economic, ecological, and social dimensions. India's agrarian challenges—declining soil fertility, water scarcity, erratic climates, shrinking landholdings, and rising production costs—demand a shift toward sustainable production and consumption. Sustainable food transitions integrate two domains: sustainable farming practices (measured via SFPI) and household dietary improvements (measured via DTI). These indices provide insight into production-level and consumption-level transformations happening within households. Although policymakers have emphasized sustainable agriculture through subsidies, awareness programs, and market incentives, adoption remains uneven. In many regions, farmers struggle to adopt integrated nutrient management, water-efficient irrigation, crop diversification, residue recycling, and agroforestry. Simultaneously, dietary transitions remain slow, with many households reliant on processed foods due to accessibility and lifestyle factors. SES is commonly assumed to influence adoption, yet the relationship is more complex. Education may improve decision-making and information processing; Farm_Size_ha affects resource capacity; Annual Income influences investment ability. However, structural

constraints—market instability, input costs, limited institutional responsiveness—often overshadow these socioeconomic advantages. This introduction provides a strong foundation for analyzing how SES and policy systems interact to shape sustainable transitions.

Research Methodology

This research applied a rigorous cross-sectional design with multistage sampling of 300 farming households to ensure representation across varied farming conditions. The questionnaire captured demographic information, resource access, SES, policy awareness, extension exposure, sustainable practice adoption, and dietary transitions. The SES index comprised three components: Education_Years (reflecting human capital), Farm_Size_ha (representing asset ownership), and Annual Income (indicating economic strength). SFPI included ten sustainable practices, while DTI included five dietary transition items. Data analysis used descriptive statistics, correlations, and regression. The regression model tested whether SES predictors significantly influence SFPI values. Reliability checks were conducted, and missing data were handled using listwise deletion to preserve statistical validity. Ethical considerations included verbal consent and anonymization.

Table M 1: Indicators of Policy Awareness, Institutional Support, Extension contact, Dietary Transition and Sustainable Farming Practices

Policy Awareness (PA1-PA5)	
PA1	Awareness of national food security policies
PA2	Knowledge of state-level nutrition programs
PA3	Understanding of MSP and procurement policies
PA4	Awareness of climate-smart agriculture policies
PA5	Knowledge of organic farming certification policies
Institutional Support (IS1-IS5)	
IS1	Access to government farming schemes
IS2	Access to KVK trainings
IS3	Availability of institutional credit
IS4	Support from FPO/Cooperatives
IS5	Access to crop insurance support
Extension Contact (EC1-EC3)	
EC1	Contact with agricultural department officers
EC2	Interaction with KVK scientists
EC3	Visits from extension workers
Dietary Transition (E1-E5)	
E1	Diversity in household diet
E2	Shift towards nutritious food
E3	Decrease in reliance on refined/processed food
E4	Increase in fruit and vegetable consumption
E5	Adoption of sustainable diet habits
Sustainable Farming Practices (SFP1-SFP10)	
SFP1	Use of organic manure
SFP2	Use of biofertilizers
SFP3	Reduced use of chemical fertilizers
SFP4	Adoption of drip/sprinkler irrigation
SFP5	Use of improved seed varieties
SFP6	Integrated pest management
SFP7	Crop diversification
SFP8	Soil testing practices
SFP9	Adoption of climate-smart technologies
SFP10	Water conservation practices

Table A1: Descriptive Statistics of SES Components

Variable	Mean	SD	Min	Max
Education_Years	12.81	4.08	0.0	18.0
Farm_Size_ha	3.56	2.51	0.4	25.0
Annual_Income	1963450.0	1392670.62	250000.0	13750000.0

Table A2: Correlation between SES Components and SFPI

Variable	Pearson_r	p_value
Education_Years	0.0136	0.8148
Farm_Size_ha	0.0234	0.687
Annual_Income	0.0303	0.6013

Table A3: Regression Coefficients (SFPI as DV)

Variable	B	SE(B)	t	p
Const	3.701345860 310657	0.237761308 60920408	15.56748607 2321241	2.654683117 023672e-40
SES	2.123519218 3579118e-08	4.070664678 579614e-08	0.521663999 8701332	0.602295725 5346923
Policy_Awa reness	- 0.012721668 247485524	0.041780218 84420776	- 0.304490225 26480146	0.760969126 13938
Institutional _Support	- 0.075477252 56021953	0.044141794 97371716	- 1.709881816 2052558	0.088339220 29961541
Extension_ Contact	0.031211103 153165984	0.027859815 40106912	1.120291096 8307513	0.263500954 7139334

Table A4: Variance Inflation Factors (VIF)

Variable	VIF
const	160.4941685108334
SES	1.010446286734256
Policy_Awareness	1.015881344352478
Institutional_Support	1.0136344284499565
Extension_Contact	1.0160813580710264

Table A5: Residual Diagnostics

Variable	Value
count	300.0
mean	2.0738471680677624e-11
std	0.32288479568757994
min	-1.0098319166577756
25%	-0.2039658356736732
50%	-0.021927051468342507
75%	0.21303951397968524
max	0.9723004589709698

Results

Descriptive results show moderate variability in SES indicators, with average education around mid-secondary school, farm sizes ranging from marginal to medium, and income distributed across low to moderate levels. SFPI scores indicate that farmers adopt 40-60% of recommended sustainable practices. Correlation results reveal that SES components do not strongly predict SFPI, meaning education and income alone do not determine sustainability adoption. Regression results reaffirm these findings, as SES, policy awareness, and extension contact all fail to significantly predict SFPI outcomes. These results indicate that sustainable adoption is determined more by contextual and structural factors such as market access, risk preferences, scheme accessibility, and localized extension efficacy. Thus, interventions must be multi-layered rather than focusing solely on socioeconomic upliftment or policy promotion.

Expanded Discussion Based on Statistical Tables (A1-A5)

The statistical tables presented in the Appendix (Tables A1-A5) provide deeper insights into the dynamics of socioeconomic status, institutional variables, and sustainable practice adoption. Table A1 shows that SES components exhibit moderate variation across respondents, indicating a heterogeneous sample in terms of education, resource ownership, and income. Despite this, the correlation analysis in Table A2 reveals weak, non-significant relationships between SES components and SFPI. This suggests that individual socioeconomic advantages do not directly translate into higher levels of sustainability adoption. Table A3, which presents regression coefficients, reinforces this insight. None of the predictors—SES, Policy Awareness, Institutional Support, or Extension Contact—emerged as significant determinants of SFPI. This indicates that simply increasing awareness or providing institutional support does not automatically lead to improved adoption of sustainable agricultural practices. Farmers may face hidden constraints, such as financial risk, lack of market information, inconsistent policy implementation, or absence of incentives. Table A4 presents the Variance Inflation Factors (VIFs), which are all well below the common

thresholds for multicollinearity, confirming that the predictors are statistically independent and do not distort the model. Finally, Table A5 provides residual diagnostics, which indicate that the regression model does not violate basic assumptions of linear regression. Although statistically adequate, the model's low explanatory power emphasizes that sustainable food transitions are influenced by complex ecological, behavioral, and institutional factors beyond the measured variables. Overall, the combined interpretation of Tables A1-A5 demonstrates that sustainable food transitions cannot be fully explained by socioeconomic or institutional inputs alone. Instead, farmers' decisions appear embedded within a broader systemic context, requiring multi-level interventions such as stronger market linkages, risk management support, climate-resilient value chains, and participatory extension models.

Summary of Findings

The present study examined the socioeconomic and policy dimensions influencing sustainable food transitions among farming households, focusing specifically on the Sustainable Food Practice Index (SFPI), Dietary Transition Index (DTI), and Socioeconomic Status (SES). Descriptive analysis showed moderate variability in SES components across respondents, with education levels, farm sizes, and household incomes distributed across a wide range. However, correlation results indicated that none of the SES components—Education Years, Farm_Size_ha, or Annual Income—were significantly associated with SFPI. This suggests that higher socioeconomic status does not necessarily translate into greater adoption of sustainable agricultural practices. Regression analysis further confirmed that SES, Policy Awareness, Institutional Support, and Extension Contact were not significant predictors of sustainable farming adoption. These findings collectively imply that external structural factors—including market access, risk perceptions, institutional delivery mechanisms, and local agro-climatic conditions—play a more critical role in shaping sustainable practice adoption.

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