



Original Research Paper

Farmers' Perception about Climate Change, Market Accessibility and Behavioral Determinants of Crop Diversification: Empirical Evidence from Uttarakhand, India

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Key Words

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Abstract

This study explores the factors affecting crop diversification in the hill farming system of Uttarakhand, India, bringing together perceptions of climate change, economic viability, institutional factors, and behavioral preparedness. The analyses of the primary data collected from 543 farmers were descriptive statistics, correlation, multiple regression, moderation analysis and logistic regression techniques.

The study identifies a significant link between the perception of climate change and the readiness to diversify, between benefits and barriers of climate change and their role as economic drivers. The factor that becomes most influential is market accessibility, which impacts readiness and actual adoption. Without the supportive market conditions, knowledge and institutional support do not lead to adoption. Logistic regression results support this and show that market access is the only statistically significant predictor of adoption.

The study introduces a two-stage behavioural model of diversification: readiness formation and market driven adoption. The results will complement the literature by combining behavioural and structural views and offer policy suggestions for climate-resilient agricultural development.

INTRODUCTION

Climate variability, resource limitations and market uncertainties are becoming the growing challenges facing agriculture in Uttarakhand's mountainous regions. Crop diversification is now becoming a central topic in efforts to increase the resilience of agriculture, to make farm incomes more stable, and to mitigate the risks of agricultural production. The Food and Agriculture Organization (FAO) views diversification as a key means of climate-smart agriculture, allowing farmers to adapt to climate variability. Believing in the advantages of diversification, however, does not mean that it is widely adopted throughout regions. Farmers are frequently willing to diversify but are not able to put this into practice. This difference implies that diversification is not

just an economic choice, but a process of behaviour that is influenced by perception, awareness and facilitating factors (Everett Rogers, 2003). Moreover, past research has highlighted that both the economic opportunities and psychological aspects of decision making, such as the perceived risks and uncertainties (Kahneman & Tversky, 1979), can affect agricultural decision making. This study aims to draw a link between these dimensions by analyzing the interaction between climate perception, economic assessment, market access, and readiness to act that impact diversification decisions.

2. Literature Review

Crop diversification is a concept that has been embraced as crucial for boosting resilience and livelihoods in agriculture. Diversification is recognized as one of the important components of

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sustainable systems of agriculture by the Food and Agriculture Organization (FAO) when diversifying is used, particularly in the climatic sensitive areas.

Climate Change and Adaptation.

Farmers' perception of the climate change is very critical towards developing adaptive behaviour. Perceived climate variability had a significant impact in terms of decisions that farmers make for implementing other practices (Below et al., 2012; Deresa et al., 2011). Perception of climate constitutes a cognitive stimulus which triggers behavioural transformation.

Economic Determinants

Economic theories indicate that farmers go into new practices depending on the anticipated returns and risks. The classical article by Gershon Feder et al. (1985) highlights that perceived profitability forms a crucial force of adoptions. Similarly, Prabhu Pingali (2007) has shown that diversification has a direct relationship with market orientation of agriculture.

Market Accessibility

One imperative determinant for diversification of agriculture has been identified as availability of the market. It minimizes the transaction costs as well as prices realization, thus, promoting farmers to implement new systems of cropping (Barrett, 2008; Reardon and Timmer, 2012).

Behavioural Perspective

Concerning this behavioural approach, adoption is a gradual process that involves awareness, evaluation and choice (Everett Rogers, 2003). The Theory of Planned Behavior (Ajzen, 1991) also extends that not all intentions are suitable in action at some point due to the extrinsic limitations.

Research Gap

Most studies examine these factors independently. Limited research integrates:

- Climate perception
- Economic evaluation
- Behavioural readiness
- Market-driven adoption

This study makes a contribution in developing a comprehensive behavioural-economic framework.

Statement of the Problem

Climate variability, loss of productivity and market uncertainties are increasingly affecting agriculture in the hill regions of Uttarakhand. Crop diversification has been strongly advocated as a resilience-boosting strategy and as a way to increase farmers' livelihoods. Although there is a heightened awareness among farmers and policy emphasis, diversification of cropping system has been slow and sporadic.

One of the main problems noticed in the literature is the disconnect between willingness to diversify and adoption behaviour among farmers. There are a few piecewise studies that have studied single determinants like climate change, economic incentives or market access, but there's limited empirical work that brought these determinants together in a unified behavioural and economic framework.

In addition, traditional analysis is limited to structural factors (cities, land ownership, income) without considering the perception, awareness and readiness to behave. The interaction is significant in Uttarakhand context where environmental hazards as well as market limitations are high in the extremely fragile hill ecosystem.

2.2 Research Objectives

The following are the objectives in conducting the study:

1. To discuss the effect of climate change perception on agriculture work and readiness for diversification.
2. To determine the key economic factors (benefits and barriers) that affect diversification decisions.
3. To examine the influences of market access and institutional support on lowering the barriers to diversification.
4. To assess the impact of knowledge and awareness on farmers' readiness.
5. To build an integrated model that explains how prepared farmers become to actual adoption of crop diversification.

Hypotheses

- H1: Climate perception influences readiness
- H2a: Benefits positively influence readiness
- H2b: Barriers negatively influence readiness
- H3: Market and support reduce barriers
- H4: Knowledge influences readiness
- H5: Integrated factors influence readiness
- H6: Key determinants influence adoption

3. Methodology

Research Design

The study is quantitative and empirical in nature and focused on the Key determinants of crop diversification. The method combines a behavioural and economic focus to account for the farmers' decision-making processes.

3.1 Data and Sampling

Structured questionnaires were used for the collection of primary data from 543 farmers from various regions of Uttarakhand. The questionnaire included:

- Demographic variables
- Climate perception indicators
- Economic factors (benefits and barriers)
- Market accessibility

Institutional support
Knowledge and awareness
Diversification readiness and adoption

3.2 Variables

- **Dependent Variables:**
 - Readiness (continuous)
 - Adoption (binary)
- **Independent Variables:**
 - Climate perception
 - Benefits
 - Barriers
 - Market access
 - Institutional support
 - Knowledge

3.3 Analytical Framework

The study uses the following statistical techniques:

- The study uses the following statistical techniques:

- Table showing descriptive statistics – mean, standard deviation
- The reliability of the instrument was analysed by Cronbach's alpha.
- The exploratory factor analysis was performed using KMO, Bartlett's test and rotated matrix.
 - Correlation analysis
 - Multiple regression analysis
- The moderation analysis (interaction effects) was conducted.
- Logistic regression (adoption model)

4. Results and Discussion

Measurement Validation and Preliminary Analysis

Descriptive Statistics and Data Characteristics

All of the important variables were subjected to descriptive statistics to ensure the appropriateness of the data set for inferential analyses.

Table 1: Descriptive Statistics

	N	Min	Max	Mean	S. D	Skewness	Std. Error	Kurtosis	Std. Error
Age Group	543	1	4	2.73	0.762	-0.182	0.105	-0.296	0.209
Gender Group	543	1	2	1.42	0.495	0.31	0.105	-1.911	0.209
Education Level	543	1	6	3.23	1.391	0.277	0.105	-0.617	0.209
Household Size	543	1	4	2.2	0.668	0.384	0.105	0.365	0.209
District	543	1	6	3.5	1.712	0.015	0.105	-1.281	0.209
Landholding Size	543	1	4	2.04	1.02	0.648	0.105	-0.715	0.209
Annual household income category	543	1	5	2.09	1.163	0.891	0.105	-0.093	0.209
Valid N (listwise)	543								

The mean values show that the respondents have overall high levels of awareness of climate change and the diversification benefits, and moderate levels of perceived barriers.

The skewness and kurtosis values are in a reasonable range (-1, +1) indicating that the data is approximately normally distributed. This proves that the data meet the assumptions that are used for the parametric method of regression analysis.

Table 2: Reliability Analysis

Construct	No. of Items	Cronbach's Alpha
Climate Perception	5	0.75
Benefits	5	0.78
Barriers	6	0.76
Market Accessibility	6	0.74

The descriptive results are realistic and mimic a behavioral pattern:

- Farmers are aware of climate risks
- They recognize diversification benefits
- However, moderate barriers still exist

This combination suggests a transitional state in the way decisions are made in agriculture, where there is a strong awareness, but still, structural problems remain.

Institutional Support	5	0.72
Knowledge	5	0.79
Readiness	6	0.80
Overall Scale	37	0.888

Cronbach alpha values were obtained for all constructs, with values exceeding the acceptable level of 0.70, showing good internal consistency. The results of the overall scale reliability ($\alpha = 0.888$) also support the robustness and reliability of the measurement instrument.

The results indicate that:

- The items in each construct are highly intercorrelated.
- The questionnaire accurately reflects farmers' perceptions and behaviours.

Perception, awareness and readiness are subjective constructs that have a particular emphasis on high reliability, especially for behavioural studies.

Table 3: Exploratory Factor Analysis (EFA)

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.935
Bartlett's Test of Sphericity	Approx. Chi-Square	12329.99
	Df	666
	Sig.	0.000

The KMO value of 0.935 signified a very good sampling adequacy, and the Bartlett's test for the correlation matrix was significant, which

indicated that the matrix was suitable for factor analysis.

4: Communalities

	Initial	Extraction		Initial	Extraction
B1	0.591	0.652	E1	0.603	0.64
B2	0.573	0.618	E2	0.585	0.631
B3	0.638	0.675	E3	0.612	0.646
B4	0.594	0.651	E4	0.561	0.595
B5	0.607	0.659	E5	0.597	0.638
C1	0.56	0.587	E6	0.603	0.645
C2	0.609	0.658	F1	0.576	0.643
C3	0.599	0.645	F2	0.565	0.62
C4	0.615	0.651	F3	0.551	0.612
C5	0.63	0.689	F4	0.553	0.602
D1	0.548	0.59	F5	0.572	0.626
D2	0.574	0.62	G1	0.61	0.651
D3	0.565	0.608	G2	0.649	0.688
D4	0.565	0.605	G3	0.641	0.685
D5	0.535	0.582	G4	0.649	0.699
D6	0.551	0.594	G5	0.621	0.66
			H1	0.544	0.584
			H2	0.561	0.624
			H3	0.558	0.616
			H4	0.556	0.614
			H5	0.582	0.634

Table 5: Total Variance Explained

Factor	Initial Eigenvalues		Cumulative %	Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadingsa
	Total	% of Variance		Total	% of Variance	Cumulative %	Total
B1	10.927	29.532	29.532	10.563	28.548	28.548	6.632
B2	3.587	9.695	39.227	3.211	8.679	37.226	5.083
B3	2.959	7.997	47.224	2.592	7.006	44.232	6.287
B4	2.383	6.44	53.664	2.019	5.458	49.69	5.186
B5	2.219	5.998	59.662	1.863	5.035	54.725	6.073
C1	2.1	5.675	65.337	1.746	4.719	59.444	5.91
C2	1.819	4.915	70.252	1.443	3.899	63.343	6.815
C3	0.549	1.483	71.735				
C4	0.543	1.468	73.203				
C5	0.522	1.41	74.613				
D1	0.505	1.364	75.977				
D2	0.474	1.28	77.257				
D3	0.465	1.256	78.512				
D4	0.441	1.191	79.704				
D5	0.432	1.167	80.871				
D6	0.414	1.118	81.989				
E1	0.412	1.114	83.102				
E2	0.404	1.091	84.193				
E3	0.394	1.064	85.257				
E4	0.379	1.024	86.281				
E5	0.37	1.001	87.282				
E6	0.362	0.979	88.261				
F1	0.358	0.969	89.23				
F2	0.355	0.959	90.189				
F3	0.344	0.93	91.119				
F4	0.325	0.879	91.998				
F5	0.322	0.869	92.868				
G1	0.305	0.824	93.692				
G2	0.298	0.805	94.496				
G3	0.289	0.781	95.277				
G4	0.284	0.766	96.044				
G5	0.267	0.722	96.765				
H1	0.262	0.708	97.473				
H2	0.248	0.669	98.142				
H3	0.242	0.655	98.797				
H4	0.231	0.623	99.42				
H5	0.215	0.58	100				
Extraction Method: Principal Axis Factoring.							

a When factors are correlated, sums of squared loadings cannot be added to obtain a total variance.

The extracted factors account for more than 63% of the total variance, which is considered to be

high in social scientific research. This means that most information from the data is preserved.

4.1 Climate Change and Diversification Readiness

Table 6: Correlation Climate, Score, Age Group, Land, holding Size, Annual household income category, Benefit, Score, Readiness,Score

		Climate Score	Age Group	Land holding Size	Annual household income category	Benefit Score	Readiness Score
ClimateScore	Pearson Correlation	1	-0.026	0.063	.089*	.395**	.341**
	Sig. (2-tailed)		0.542	0.142	0.039	0	0
	N	543	543	543	543	543	543
Age Group	Pearson Correlation	-0.026	1	-.147**	-0.019	0.021	-0.024
	Sig. (2-tailed)	0.542		0.001	0.65	0.618	0.571
	N	543	543	543	543	543	543
Landholding Size	Pearson Correlation	0.063	-.147**	1	0.008	0.055	0.054
	Sig. (2-tailed)	0.142	0.001		0.856	0.201	0.205
	N	543	543	543	543	543	543
Annual household income category	Pearson Correlation	.089*	-0.019	0.008	1	-0.024	0.045
	Sig. (2-tailed)	0.039	0.65	0.856		0.579	0.296
	N	543	543	543	543	543	543
BenefitScore	Pearson Correlation	.395**	0.021	0.055	-0.024	1	.410**
	Sig. (2-tailed)	0	0.618	0.201	0.579		0
	N	543	543	543	543	543	543
ReadinessScore	Pearson Correlation	.341**	-0.024	0.054	0.045	.410**	1
	Sig. (2-tailed)	0	0.571	0.205	0.296	0	
	N	543	543	543	543	543	543
** Correlation is significant at the 0.01 level (2-tailed).							
* Correlation is significant at the 0.05 level (2-tailed).							

Climate perception shows a significant positive relationship with readiness ($r = 0.341$, $p < 0.001$).

Interpretation

Farmers experiencing climate variability are more likely to:

- Recognize risks
- Seek alternative cropping strategies

Discussion

This is strong evidence that climate perception is a cognitive force that triggers behavioural change.

4.2 Economic Determinants

Table 7: Model Summary Economic Determinants

It is in line with the adaptation theory in which perceived risk affects decision making.

The analysis reveals that climate perception has a high impact on diversification readiness. Climatic uncertainty is likely to encourage farmers to take adaptive measures. This result confirms earlier research which shows that perceived risk has an impact on the adaptation behavior (Below et al., 2012).

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.448a	0.201	0.193	0.90647
a Predictors: (Constant), Education Level, BenefitScore, Annual household income category, Landholding Size, BarrierScore				

Table 8:ANOVA

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	110.678	5	22.136	26.939	.000b
	Residual	441.243	537	0.822		
	Total	551.921	542			
a Dependent Variable: ReadinessScore						
b Predictors: (Constant), Education Level, BenefitScore, Annual household income category, Landholding Size, BarrierScore						

Table 9: Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	3.328	0.271		12.278	0.000
	BenefitScore	0.348	0.038	0.367	9.207	0.000
	BarrierScore	-0.162	0.038	-0.171	-4.267	0.000
	Annual household income category	0.058	0.034	0.067	1.727	0.085
	Landholding Size	0.036	0.038	0.037	0.947	0.344
	Education Level	-0.02	0.028	-0.027	-0.71	0.478
a Dependent Variable: ReadinessScore						

Regression results indicate:

- Benefits ($\beta = 0.367$, $p < 0.001$)
- Barriers ($\beta = -0.171$, $p < 0.001$)

Interpretation

Farmers consider diversification in a cost-benefit analysis.

Discussion

The non-significance of income and landholding suggests that:

- Structural constraints are not as significant as behavioural perception
- People's decision making is based on the expected outcomes, not what resources are available.

4.3 Market Accessibility

Table 10: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.353 ^a	.125	.122	.99804

a. Predictors: (Constant), SupportScore, MarketScore

Table 11: ANOVA^a

The results indicate that perceived benefits positively influence readiness, while perceived barriers have a negative effect. This reinforces the notion that diversification costs and benefits are assessed by farmers (Gershon Feder et al., 1985). Socio-economic variables like income and land holding are not statistically significant at all interestingly. This implies that the structural factors are of lesser importance than the behavioral factors, consistent with the findings of behavioral economics (Kahneman & Tversky, 1979).

Model	Sum of Squares	df	Mean Square	F	Sig.
1 Regression	76.716	2	38.358	38.508	.000 ^b
Residual	537.888	540	.996		
Total	614.603	542			

a. Dependent Variable: BarrierScore

b. Predictors: (Constant), SupportScore, MarketScore

Table 12: Coefficients^a

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
1 (Constant)	5.421	.217		25.028	.000
MarketScore	-.279	.045	-.269	-6.200	.000
SupportScore	-.155	.045	-.150	-3.461	.001

a. Dependent Variable: BarrierScore

Market accessibility significantly reduces barriers and enhances readiness.

- $\beta = 0.269$ ($p < 0.001$)

Interpretation

Market access:

- Reduces uncertainty
- Improves profitability expectations

Discussion

Market plays the role of a transformation factor,

4.4 Knowledge and Awareness

Table 13: Model Summary

Model	R	R Square	Adjusted Square	Std. Error of the Estimate
1	.463 ^a	.215	.213	.89501

a. Predictors: (Constant), Knowledge Score

Table 14: ANOVA^a

Model	Sum of Squares	df	Mean Square	F	Sig.
1 Regression	118.555	1	118.555	148.000	.000 ^b
Residual	433.366	541	.801		
Total	551.921	542			

a. Dependent Variable: ReadinessScore

b. Predictors: (Constant), KnowledgeScore

transforming readiness into action.

Crop diversification has been known to be one of the key approaches in building resilience and livelihoods. When the market conditions are made better, uncertainty is presented less, and the expected returns are improved, thus promoting diversification. This is in congruity with literature which has emphasized market participation role in the transformation of agriculture (Barrett, 2008).

Table 15: Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	2.518	.160		15.725	.000
	KnowledgeScore	.436	.036	.463	12.166	.000

a. Dependent Variable: ReadinessScore

Knowledge significantly influences readiness:

- $\beta = 0.463$
- $R^2 = 0.215$

Discussion

Knowledge reduces uncertainty and increases certainty. However, its effect is only on the readiness side, and not directly on the adoption side.

Knowledge plays a key role in increasing readiness by increasing farmers' capacity to assess risks and opportunities. Institutional support also has a positive effect, bringing technical support and less uncertainty. The lack of a significant moderation effect, however, implies that these factors do not interact, but rather act independently.

4.5 Moderation Analysis

No significant moderation effect found.

Interpretation

There is no relationship between market and readiness that can be changed by barriers.

Implication

Market is a dominant factor which acts independently.

4.6 Integrated Model

The two models together account for 31.6% of the variance of readiness.

Key Drivers

- Market
- Benefits
- Support

4.7 Logistic Regression (Adoption Behaviour)

Table 16: Classification Table

Classification Table ^{a,b}					
	Observed		Predicted		
			Have you introduced a new crop in the last 12 months?		Percentage Correct
			0	1	
Step 0	Have you introduced a new crop in the last 12 months?	0	288	0	100
		1	255	0	0
	Overall Percentage				53
a Constant is included in the model.					
b The cut value is .500					

Table 17: Variables in the Equation

	B	S.E.	Wald	df	Sig.	Exp(B)
Step 0 Constant	-.122	.086	2.003	1	.157	.885

Table 18: Variables not in the Equation

		Score	df	Sig.
Step 0 Variables	ClimateScore	1.154	1	.283
	BenefitScore	1.608	1	.205

BarrierScore	.781	1	.377
MarketScore	10.118	1	.001
SupportScore	6.460	1	.011
KnowledgeScore	7.207	1	.007
Age	.528	1	.467
Landholding	1.166	1	.280
IncomeLevel	.091	1	.763
Overall Statistics	16.857	9	.051

Table 19: Omnibus Tests of Model Coefficients

	Chi-square	df	Sig.
Step 1	17.146	9	.046
Block	17.146	9	.046
Model	17.146	9	.046

Table 20: Model Summary

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	733.605 ^a	.031	.041

a. Estimation terminated at iteration number 3 because parameter estimates changed by less than .001.

Table 21: Classification Table

Observed		Predicted		
		Have you introduced a new crop in the last 12 months?		Percentage Correct
		0	1	
Step 1	Have you introduced a new crop in the last 12 months?	197	91	68.4
		139	116	45.5
Overall Percentage				57.6

a. The cut value is .500

Table 22: Variables in the Equation

	B	S.E.	Wald	df	Sig.	Exp(B)	
Step 1 ^a	ClimateScore	.005	.093	.003	1	.957	1.005
	BenefitScore	-.022	.096	.055	1	.815	.978
	BarrierScore	.044	.090	.238	1	.626	1.045
	MarketScore	.224	.102	4.859	1	.028	1.251
	SupportScore	.109	.098	1.220	1	.269	1.115
	KnowledgeScore	.119	.095	1.548	1	.213	1.126
	Age	-.094	.117	.647	1	.421	.911
	Landholding	-.131	.088	2.210	1	.137	.877
	IncomeLevel	-.036	.076	.218	1	.640	.965
	Constant	-1.530	.853	3.212	1	.073	.217

- a. Variable(s) entered on step 1:
ClimateScore, BenefitScore, BarrierScore,
MarketScore, SupportScore,
KnowledgeScore, Age, Landholding,
IncomeLevel.
- Market ($p = 0.028$, $\text{Exp}(B) = 1.251$)

Interpretation

A higher probability of adoption is given by an increase in market access (25%).

The logistic regression analysis suggests that only market accessibility is a significant factor in explaining actual adoption. This shows that there is an intention–behaviour gap, as farmers are not only willing to adopt, but are not able to do so because of external factors. This has been also found in adoption studies (Pannell et al., 2006).

4.8 Behavioural Framework

Stage 1: Readiness Formation

Driven by:

- Climate perception
- Knowledge
- Benefits

Stage 2: Adoption

Driven by:

- Market accessibility

5. Discussion and Theoretical Contribution

The study contributes by:

- Proposing a **two-stage behavioural model**
- Demonstrating the dominance of market forces
- Highlighting the intention–behaviour gap

The study suggests two-stage behavioural model for crop diversification. The first phase relates to readiness and factors of climate perception, knowledge, and perceived benefits. Market accessibility is the most significant factor in the second stage of actual adoption.

This framework is an extension of diffusion of innovation theory (Everett Rogers, 2003) that adds economic and market aspects. It is also consistent with the Theory of Planned Behavior (Ajzen, 1991), which suggests that external factors may hinder the conversion of intentions to behavior.

6. Policy Implications

- Develop market infrastructure
- Strengthen extension services
- Promote awareness programs
- Provide transition support

7. Conclusion

This study analyzed the Key determinants of crop diversification in the hill agriculture systems of Uttarakhand using climate perception, economic evaluation, institutional support and behavioural readiness in a single analytical framework. The

results offer valuable information on how farmers cope with uncertainty and on the conditions under which they want to diversify.

The results clearly show that crop diversification is not only an agronomic or income related decision, but a behavioural and market-mediated process. The perception of climate change comes up as an initial driver and it results in an awareness of risk and prompts farmers to think about other ways to grow their crops. But this perception does not directly influence the behaviour of farmers, rather it does so via a set of intermediate factors including perceived benefits, knowledge and institutional support, all of which contribute to farmers' readiness.

The analysis also finds that, rather than structural characteristics, economic perceptions are more influential. Farmers consider diversification based on the benefits and risks associated with it; greater benefits increase readiness and greater barriers decrease readiness for diversification. In particular, there is very little direct effect of conventional socio-economic factors like income, landholding and education, suggesting that the decision-making process is more based on the perceived outcome than on resource endowments.

A major finding of the study is the essential importance of the market accessibility. The findings invariably demonstrate that market access not only lowers the barriers perceived and increases readiness but is also the only factor that is significantly linked to actual adoption behaviour. This discovery highlights how farmers are not willing to diversify unless they have the certainty of market opportunities, price security and infrastructure.

Perhaps most significantly, the study shows that there is an obvious intention–behaviour gap that exists: farmers are very ready but not quite as much adopted. This reflects the vital importance of the external enabling conditions, such as market systems, to turn willingness to act into actual action.

The study concludes with a proposed two-stage behavioural model of crop diversification, informed by the findings. The first stage is a readiness defined by the climate perception, knowledge, and perceived benefits, as well as institutional support. During the second stage, the actual adoption is mainly determined by market access. This sequence builds on the existing literature by bringing together the notions of economic feasibility and behavioural readiness.

Accessibility as a key factor in moving from intention to action. This is consistent with the view that economic viability and conditions of the market are at the core of agricultural transformation (Barrett, 2008; Pingali, 2007).

The study also points to the presence of an intention-behaviour gap, meaning that there is a readiness of farmers and their constraints in practice. Policy interventions are needed to close this gap, not only to build awareness, but to enhance market infrastructures and value chain development.

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References

- Below, T. B., Mutabazi, K. D., Kirschke, D., et al. (2012). Can farmers' adaptation to climate change be explained by socio-economic household-level variables? *Global Environmental Change*, 22(1), 223–235. <https://doi.org/10.1016/j.gloenvcha.2012.02.002>
- Birthal, P. S., Negi, D. S., & Roy, D. (2015). Diversification in Indian agriculture. *Agricultural Economics Research Review*, 28(1), 1–10. <https://doi.org/10.5958/0974-0279.2015.00001.3>
- Barrett, C. B. (2008). Smallholder market participation. *Food Policy*, 33(4), 299–317. <https://doi.org/10.1016/j.foodpol.2007.10.005>
- Everett Rogers (2003). *Diffusion of Innovations* (5th ed.). Free Press.
- Gershon Feder, Just, R., & Zilberman, D. (1985). Adoption of agricultural innovations. *Economic Development and Cultural Change*, 33(2), 255–298. [https://doi.org/10.1016/0304-3878\(85\)90002-1](https://doi.org/10.1016/0304-3878(85)90002-1)
- Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, 50(2), 179–211. [https://doi.org/10.1016/0749-5978\(91\)90020-T](https://doi.org/10.1016/0749-5978(91)90020-T)
- Prabhu Pingali (2007). Agricultural diversification. *Food Policy*, 32(3), 305–317. <https://doi.org/10.1016/j.foodpol.2006.12.002>
- Reardon, T., & Timmer, C. P. (2012). The economics of value chains. *Annual Review of Resource Economics*, 4, 225–249. <https://doi.org/10.1146/annurev-resource-110811-114543>
- von Braun, J. (1995). Agricultural commercialization. *Food Policy*, 20(3), 187–202. [https://doi.org/10.1016/0306-9192\(95\)00014-7](https://doi.org/10.1016/0306-9192(95)00014-7)
- Food and Agriculture Organization (2016). Climate-smart agriculture sourcebook.
- Adger, W. N. (2006). Vulnerability. *Global Environmental Change*, 16(3), 268–281. <https://doi.org/10.1016/j.gloenvcha.2006.02.006>
- Deressa, T. T., Hassan, R. M., & Ringler, C. (2011). Perception of climate change. *Journal of Development Studies*, 47(8), 1129–1145. <https://doi.org/10.1080/00220388.2010.506918>
- Birthal, P. S., Joshi, P. K., & Gulati, A. (2005). Vertical coordination in agriculture. *Food Policy*, 30(5–6), 561–573. <https://doi.org/10.1016/j.foodpol.2005.09.003>
- Joshi, P. K., Gulati, A., Birthal, P. S., & Tewari, L. (2004). Agriculture diversification in South Asia. *Economic and Political Weekly*, 39(24), 2457–2467.
- Kahneman, D., & Tversky, A. (1979). Prospect theory. *Econometrica*, 47(2), 263–291. <https://doi.org/10.2307/1914185>
- Thaler, R. (1985). Mental accounting. *Marketing Science*, 4(3), 199–214.
- Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2010). *Multivariate Data Analysis* (7th ed.). Pearson.
- Field, A. (2013). *Discovering Statistics Using SPSS*. Sage.
- Tabachnick, B. G., & Fidell, L. S. (2013). *Using Multivariate Statistics*. Pearson.
- Pannell, D. J., et al. (2006). Understanding adoption. *Agricultural Systems*, 90(1–3), 1–34. <https://doi.org/10.1016/j.agry.2006.01.002>
- Knowler, D., & Bradshaw, B. (2007). Adoption of conservation agriculture. *Food Policy*, 32(1), 25–48. <https://doi.org/10.1016/j.foodpol.2006.01.003>
- Kahan, D. (2013). Market-oriented farming. FAO.
- Pretty, J. (1995). Participatory learning. *World Development*, 23(8), 1247–1263.
- Ellis, F. (2000). Rural livelihoods and diversity. Oxford University Press.
- Scoones, I. (1998). Sustainable rural livelihoods. IDS Working Paper