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Bridging the intention–adoption gap in climate-resilient agriculture: Evidence from hill farmers in Uttarakhand, India

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Abstract---Although farmers' awareness on climate change and policy interest in crop diversification in hill regions have been growing, the actual adoption of crop diversification among farmers in hill regions is still low. The study analyzes the behavioural readiness and actual adoption of diversification practices among the farmers in Uttarakhand in the study area. Descriptive statistics, correlation, multiple regression and logistic regression techniques are employed for analysis of primary data collected from 543 farmers. The findings show that the perception of climate change, climate knowledge, and perceived benefits are positively associated with improving diversification readiness. But these do not necessarily lead to adoption. The only variable to be statistically significant in predicting adoption behaviour is market accessibility, indicating the existence of an intention–adoption gap. The study proposes a two-stage behavioural framework in which readiness is shaped by perception and awareness, while adoption is constrained by market conditions. The results add to the literature by moving beyond the research on determinants of readiness to research on barriers to implementation and provide policy guidance for improving agricultural resilience in mountain areas.

Keywords---Intention–Adoption Gap, Climate Change Adaptation, Crop Diversification, Market Accessibility, Farmer Behaviour, Uttarakhand.

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1 Introduction

Farming in the mountainous areas is by definition susceptible because the nature of these ecosystems is fragile, landholdings are broken, and markets are not easily accessible. These structural problems are also exacerbated in the Indian Himalayan state of Uttarakhand by growing climatic variability in the form of unpredictable rainfall, rise in temperatures and increased cases of crop losses. These changes have far reached consequences on farm level decision and livelihood security.

Crop diversification in this regard has been championed and promoted as a viable approach to promote resilience, income stabilization, and minimize risks in production.
Diversification is considered one of the pillars of climate-smart agriculture by the Food and Agriculture Organization especially in areas where mono-cropping system is highly vulnerable to environmental shocks (FAO, 2016). Empirical research indicates that diversification has the potential to enhance stability in income and minimize susceptibility through the distribution of risk among a variety of crops (Birthal, 2015) (Pingali, 2007).

Nevertheless, the degree of implementation of such strategies by farmers is quite different across regions and socio-economic settings. The gap that can be noted in recent agricultural research is that the awareness among farmers regarding the risks of climate and the actual adaptive practice adoption is different. Farmers are ready to appreciate the value of diversification, and they readily declare to have it, but the translation of this goodwill to action has been minimal. This phenomenon is an indication that there is a more underlying behavioural problem than an economic one. This may be theoretically explained using the theory of Icek Ajzen (1991) who argued that intention does not always lead to behaviour, when there are resource constraints, opportunity constraints, or perceived control constraints.

In addition to the behavioural theory, these are also reinforced by knowledge acquired in behavioural economics. Besides the behavioural theory, these are also reinforced by knowledge gained in behavioural economics. As researchers like Daniel Kahneman have highlighted, making decisions in the face of uncertainty can be heavily affected by perceived risks and cognitive biases, instead of simply making a rational decision (Kahneman and Tversky, 1979). Uncertainty in the form of price and market access and availability of inputs may deter farmers in the agricultural setting to assume practices that would otherwise be beneficial.

Market accessibility is one of the other structural constraints that have become a key determinant of agricultural transformation. Research has always demonstrated that farmers will tend to prefer new cropping patterns when they are assured of stable markets, stable prices and lower transaction costs (Barrett, 2008; Reardon and Timmer, 2012). In hilly states such as Uttarakhand, poor infrastructure and bad market connection can more often hamper commercialization of diversified crops by farmers, thus influencing the decision to adopt.

Although there is an increasing amount of literature on crop diversification, the majority of researches have mainly concentrated on determining the determinants of adoption including income, landholding, or access to information. The gap between preparing people for behaviour and making that happen has been dealt with comparatively little attention. The gap is also of significance especially in areas where the level of awareness is rising owing to policy interventions and extension services but adoption is not even.

In this backdrop, the present study sets to explore the gap between the intention and adoption of crop diversification among the farmers of Uttarakhand. The study will offer a more subtle interpretation of the reasons why willing farmers who are diversifiable do not actually diversify as they should by combining behavioural points of view with empirical analysis. By so the study has contributed to the

literature by focusing not on why farmers adopt, but on why farmers do not adopt despite being willing to adopt, thus offering an important contribution to the policy design and implementation literature.

2. Literature Review

2.1 Crop Diversification and Agricultural Resilience

Diversification of crops has long been identified as a form of strategic reaction to agricultural risk, especially in places where there is uncertainty in the climate and resource limitations. Diversification enables farmers in weak ecosystems like Uttarakhand to share risk between different crops; hence, less overall reliance on a single source of income. Empirical data indicate that diversified farming systems help to achieve better income stability, better soil health, and better adaptability to environmental shocks (Birthal, 2015) (Pingali, 2007).

Food and Agriculture Organization underlines that climate-smart agriculture includes diversification, which is especially important in smallholder agricultural systems having high exposure to climate variability (FAO, 2016). With the incorporation of crops that have different climatic sensitivities, the farmers will be in a better position to respond to the changing climatic conditions. Nevertheless, there is no homogenous adoption of diversification practices, but rather a mix of economic factors, institutional factors as well as behavioural factors.

2.2 Climate Perception and Adaptive Behaviour.

The perception of climate change by the farmers is highly important in determining their adaptive actions. Research has revealed that people with perceptions of increased climate risk tend to shift to other farming methods, such as diversifying their crops (Below et al., 2012; Deressa et al., 2011). Perception is a cognitive filter that helps farmers perceive changes in the environment and assess possible actions.

In this context, perception of climate is not directly related to behavior, and it influences the process of forming intentions. Farmers who know about the increasing uncertainty of precipitation, temperature change, and crop failure will more likely be considering adaptation measures. When other constraints limit options, though, perception often does not lead to action.

2.3 Behavioural Perspectives: Intention–Behaviour Gap

The gap between self-intention and behaviour has been a highly debated topic in behavioural theory. Icek Ajzen (1991) says that intention determines behaviour and this is determined by attitude, subjective norms and perceived behavioural control. Especially, well-meaning people can have good intentions, but without the resources and opportunities to put the ideas into effect.

The idea is especially applicable to agricultural decision-making, where farmers can be willing to embrace better practices but are restrained by the lack of market accessibility, financial issues, and institutional flaws. This intention-behaviour gap has been noted in a variety of circumstances and this suggests that the motivating factors alone do not account for adoptions.

The behavioural economics also lend credence to this argument. Daniel Kahneman and Tversky (1979) show that uncertainty in making a decision can be affected by the perceived risks and losses. Uncertainty in the prices of their products in the market, availability of inputs and weather conditions can lead farmers not to act on their intentions even when the benefits anticipated are high.

2.4 Economic Considerations: Benefits and Barriers

Economic analysis has continued to be a key aspect of decision making by farmers. The farmers evaluate diversification in terms of anticipated returns, cost effects and risks involved. One of the problems that Gershon Feder et al. (1985) raised is that perceived profitability is one of the more important factors in the adoption process.

The perceived advantages like the diversification of income, reduction of risk, and better resource use compel the farmers to think about alternative systems of cropping. On the other hand, perceived barriers such as financial limitations, unavailability of inputs and uncertainty about the consequences are

deterrent factors. Images are typically shaped by the experiences of the past, and the availability of information and conditions of the place.
Of particular note, recent studies show that the perceived benefit or barrier of a farming decision may be more important than the real socio-economic benefits or barriers, such as income or land ownership. This indicates that this has shifted to a more behaviourally-oriented view on agricultural decisions, instead of the structural explanation.

2.5 Market Accessibility and Structural Constraints
Market accessibility is one of the structural factors; market access has been continuously cited as a decisive element of an agricultural transformation. Availability of good markets will lower transaction costs, improve price realization, and give incentives to change to new cropping patterns (Barrett, 2008; Reardon and Timmer, 2012).
Farmers in areas where market infrastructure is well-established will more readily respond to demand signals by diversifying production. Conversely, poor access to the market will lead to uncertainty about the sale of the produce thus.

2.6 Knowledge, Awareness, and Institutional Support
Information and knowledge are key in empowering farmers to assess and embrace new agricultural practices. The extension services, training schemes and institutional support mechanisms are involved in improving the awareness and technical capacity of the farmers.
Increased access to information has been shown to encourage the uptake of new practices by farmers because they are not really uncertain about the new practice or how to implement it and the confidence to take a decision is improved. Government schemes and advisory services are institutional support and further enhance adoption.
But these interventions are only effective insofar as they can deal with the practical constraints. The awareness may not be accepted if infrastructure and market connection aren't developed.

2.7 Research Gap and Contribution
Although the existing literature offers useful information on the determinants of crop diversification, most researchers have studied behavioural factors, as well as structural restrictions separately. Empirical research linking these aspects into explaining the discrepancy between readiness and actual adoption is limited.
Specifically, there are very few studies which identify the specific reasons why farmers informed about the risks of climate change, already aware of the benefits of diversification and willing to add some diversification to their portfolios still don't do it. This is a characteristic that is absent in the systems of hill agriculture which have both behaviourally ready and structurally limiting factors.
The current study overcomes this by proposing a hybrid framework which separates intention (readiness) from behaviour (actual adoption). The combination of the behavioural theory and the empirical analysis make the study more insightful in the field of agricultural decision making and contribute to the literature on climate-resilient agricultural systems.

3. Statement of the Problem

While knowledge about and policy initiatives regarding diversification have expanded, farmer knowledge and actions to climate change have been uneven. Studies that are available are mostly aimed at determining factors that affect adoption, although they tend to believe that there is a direct correlation between intention and behaviour. In practice, farmers may be risk averse and benefit seeking, and even willing to diversify, but lack the ability to do so. This means there is intention-adoption gap, the willingness to act doesn't translate to actual action.
This is of particular concern in the context of the hill agriculture in Uttarakhand because:

1. Difficult topography and broken landholdings
2. Limited access to institutionalized markets.

3. High transaction costs and uncertainty of price.

This is an important gap that needs to be understood when developing relevant agricultural policies that strive to raise awareness but also take into consideration the structural barriers.

4. Research Objectives and Hypothesis

The research will be informed by the following aims:

- ❖ To examine the relationship between behavioural readiness and actual adoption of crop diversification.
- ❖ To identify the factors responsible for the gap between intention and adoption among farmers.

Hypotheses

H1: Behavioural readiness plays a significant role in the intention of farmers but not in actual adoption.

H2: The availability of markets is a major determinant of real crop diversification adoption.

5. Methodology

The research design adopted in this study will be quantitative, cross sectional in nature, which is to study the gap between behavioural intention and actual crop diversification among the farmers in Uttarakhand. Structured questionnaire was the main tool that was used to collect the primary data, in which 543 farmers from various agro-ecological and socio-economic conditions were sampled using purposive and stratified sampling technique. The tool had multi-item items to reflect major constructs like perception of climate, perceived benefits, perceived barriers, market accessibility, institutional support, knowledge and awareness, diversification readiness, and real adoption behaviour. Likert-type scales were used to measure all perceptual variables, a common method that is used in the social sciences to measure attitudes and behavioural tendencies (Likert, 1932). To simplify data analysis, the answers to the items were grouped into composite indices, following the procedures employed in multivariate research (Hair, 2010). To test the adequacy of the sampling and to ensure the factors are suitable, the reliability of the measures was measured using Cronbach alpha, and construct validity was assessed by exploratory factor analysis, which included KaiserMeyerOlkin (KMO) measure and test of sphericity (Field, 2013; Tabachnick and Fidell, 2013). The data characters were summarized by means of descriptive statistics and the correlation analysis was employed to investigate the relationships among the variables. Various regression analysis was applied to identify factors determining the diversification readiness, while logistic regression was applied to identify the factors influencing actual diversification behaviour, particularly in differentiating between intention and implementation. This set of analytical methods enables to evaluate both behavioural and structural aspects of making decisions, and it is compatible with the existing empirical methods in the agricultural and behavioural studies (Feder, 1985; Wooldridge, 2010).

6. Results and Analysis

Table 1: Descriptive Statistics of Key Variables

Variables	N	Min	Max	Mean	SD	Sk	SE	Kurt.	SE
Climate Perception	543	1.40	7.00	4.316	1.05887	0.054	0.105	-0.215	0.209
Perceived Benefits	543	1.60	7.00	4.4004	1.06598	0.014	0.105	-0.349	0.209
Perceived Barriers	543	1.00	6.67	3.5847	1.06487	0.024	0.105	-0.452	0.209
Market Accessibility	543	1.17	6.83	4.256	1.02523	-0.271	0.105	0.128	0.209
Support	543	1.00	7.00	4.1808	1.03228	-0.107	0.105	-0.031	0.209

Variables	N	Min	Max	Mean	SD	Sk	SE	Kurt.	SE
Knowledge & Awareness	543	1.20	7.00	4.337	1.07275	-0.203	0.105	-0.374	0.209
Diversification Readiness	543	1.00	7.00	4.4085	1.00911	-0.076	0.105	-0.039	0.209
Valid N (listwise)	543								

With respect to descriptive profile, it is observed that the respondents are of comparatively high awareness and readiness with the mean scores of the majority of the variables are above 4. In particular, readiness (4.409) and benefits (4.400) show positive behavioural attitudes towards diversification. This means that farmers are not immune to change but already exist in cognitively oriented conditions of adaptive practices.

The values of skewness and kurtosis are within the acceptable statistical bounds (+1, -1) and this means that the distribution of data is approximately normal (Hair et al., 2010). This will account for the use of parametric techniques such as regression analysis.

The relatively low mean of barriers (3.585) is due to the constraints that were observed but not to a prohibitive level. The same has been observed in climate adaptation literature where farmers are willing, but are unwilling owing to uncertainty (Below et al., 2012).

Correlation Analysis

Table 2: Correlation Matrix

		Climate	Benefit	Barrier	Market	Support	Knowledge	Readiness
Climate	**R**	1	0.395**	-0.137**	0.213**	0.254**	0.302**	0.341**
	Sig. (2-tailed		0.000	0.001	0.000	0.000	0.000	0.000
	N	543	543	543	543	543	543	543
Benefit	**R**	0.395**	1	-0.247**	0.326**	0.320**	0.339**	0.410**
	Sig. (2-tailed)	0.000		0.000	0.000	0.000	0.000	0.000
	N	543	543	543	543	543	543	543
Barrier	**R**	-0.137**	-0.247**	1	-0.325**	-0.250**	-0.211**	-0.256**
	Sig. (2-tailed)	0.001	0.000		0.000	0.000	0.000	0.000
	N	543	543	543	543	543	543	543
Market	**R**	0.213**	0.326**	-0.325**	1	0.372**	0.376**	0.437**
	Sig. (2-tailed)	0.000	0.000	0.000		0.000	0.000	0.000
	N	543	543	543	543	543	543	543
Support	**R**	0.254**	0.320**	-0.250**	0.372**	1	0.380**	0.414**
	Sig. (2-tailed)	0.000	0.000	0.000	0.000		0.000	0.000
	N	543	543	543	543	543	543	543
Knowledge	**R**	0.302**	0.339**	-0.211**	0.376**	0.380**	1	0.463**
	Sig. (2-tailed)	0.000	0.000	0.000	0.000	0.000		0.000
	N	543	543	543	543	543	543	543
Readiness	**R**	0.341**	0.410**	-0.256**	0.437**	0.414**	0.463**	1
	Sig. (2-tailed)	0.000	0.000	0.000	0.000	0.000	0.000	
	N	543	543	543	543	543	543	543
**** Correlation is significant at the 0.01 level (2-tailed).**								

The correlation analysis it is seen that two variables have the highest positive correlation with diversification readiness which is knowledge (r = 0.463) and access to market (r = 0.437). This is to imply that the more knowledgeable farmers with a better market exposure will be more prone to employment of diversification measures.

Perceived benefits are also found to be positively correlated (r = 0.410) which reinforced that the economic expectations were important in the development of the behavioural intention. However, the perceived barriers show a negative correlation (r = -0.256); this suggests that the more negative the perception of barriers, the less likely the individuals are to adopt it.

These results are in line with theoretical model by Gershon Feder et al. (1985) that stipulates that decision to adopt is affected by the expected returns and perceived risk. In addition, the beneficial effect of knowledge is in line with the research on the significance of access to information in agricultural innovation (Rogers, 2003).

Regression Analysis: Determinants of Readiness

Table 3: Regression

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.586a	0.343	0.338	0.82102
a Predictors: (Constant), KnowledgeScore, BarrierScore, BenefitScore, MarketScore				

Table 4: ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	**Regression**	189.273	4	47.318	70.198	.000b
	Residual	362.648	538	0.674		
	Total	551.921	542			
a Dependent Variable: ReadinessScore						
b Predictors: (Constant), KnowledgeScore, BarrierScore, BenefitScore, MarketScore						

Table 5: Coefficients

	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	1.552	0.280		5.546	0.000
BenefitScore	0.208	0.036	0.220	5.706	0.000
BarrierScore	-0.061	0.036	-0.065	-1.723	0.085
MarketScore	0.233	0.039	0.237	5.939	0.000
KnowledgeScore	0.269	0.037	0.286	7.344	0.000
a Dependent Variable: ReadinessScore					

The regression model explains that about 34.3 % of the variation in ready occurred, thus having a good level of ability to explain the behaviour analysis. Only among all predictors, knowledge (= 0.286) is

found to be the most important predictor, followed by market accessibility (= 0.237) and perceived benefits (= 0.220).

Interestingly, there is no statistically significant effect of perceived barriers (p = 0.085), suggesting that there is no strong impact on the shaping of the readiness of perceived barriers. This indicates that these farmers are psychologically prepared to diversify even though there are constraints in place.

These results prove behavioural schools of thought that suggest that the intention-making process is highly dependent on awareness and perceived benefits as compared to constraints (Ajzen, 1991). The theory of diffusion – where information is a key determinant in influencing intentions to adopt (Everett Rogers, 2003) – also has close connections with close association to the knowledge strong role.

Logistic Regression Analysis: Adoption Behaviour

Table 6: Logistic Regression Results (Dependent Variable: Adoption)

Variable	B	Exp(B)	Sig.
Market Score	0.229	1.257	0.020
Benefit Score	-0.010	0.990	0.909
Knowledge Score	0.148	1.159	0.104
Barrier Score	0.027	1.028	0.756

Model Fit:
Chi-square = 12.997 (p = 0.011)
Nagelkerke R^2 = 0.032

The findings of the logistic regression allow having a different point of view to the readiness model. Market accessibility (p = 0.020) with an odds ratio of 25.7 is the only predictor that is statistically significant; this indicates that good market access raises the odds of adopting. The Nagelkerke R 2 is relatively low indicating that there are other structural and institutional determinants of adoption behaviour missing from the model, and hence real-life agricultural decision making behaviour is complicated.

On the other hand, benefits, knowledge and barriers appear to have little direct effect on the adoption. This inconsistency result suggests that these factors affect intention, but not behaviour. This finding is reinforced by the literature of commercialization of agriculture which conceptualizes access to markets as one of the production decision factors (Barrett, 2008; Reardon and Timmer, 2012). Farmers are lacking market channels to ensure price realisation and demand that hampers farmer's adoption.

Model Classification and Predictive Power
The classification results indicate:

- 70.8% accuracy for non-adopters
- 43.1% accuracy for adopters
- Overall accuracy: 57.8%

Medium predictive validity suggests that there are other external factors such as institutional infrastructure, policy support and risk perception that influence adoption behaviour. This further complicates the nature of agricultural decision making and demonstrates the weakness of using behavioural variables only.

Evidence of the Intention–Adoption Gap
The combined findings clearly demonstrate a structural gap:

- ✓ Readiness is influenced by knowledge, benefits, and perception

- ✓ Adoption is influenced primarily by market accessibility

This confirms that there is an intention-adoption gap that will occur when farmers intend to diversify but do not make decisions due to external constraints. This result is in line with the theoretical framework of Icek Ajzen (1991) on the role of perceived control as well as intention in behaviour. It also indicates what has been proposed by Daniel Kahneman, that uncertainty and perception of risk affects decision-making in real-life situations. The results of the analysis suggest that there are two phases of crop diversification decision processes. The first step is to get farmers ready as regards awareness, expected benefits and knowledge. In the second level, the reality adoption is affected by the structural aspects, mainly market access. This difference explains why it is imperative to go beyond interventions that are based on awareness and to work on the fortification of market systems. There is a need to consider structural constraints to produce meaningful adoption where there is behavioural readiness. The results of this research give a more in depth insight into the responsiveness of farmers operating in hill areas to climate variability in diversification decisions. The previous studies that have focused primarily on the identification of determinants of adoption have been limited, however, in that they have not distinguished between the behavioural readiness and actual implementation. The outcomes reveal that the farmers exhibited a high level of cognitive and behavioural preparedness with the highest being knowledge, perceived benefits and climate awareness as triggers. This is to suggest a lack of disinterest among farmers in diversification, but rather a strong appreciation of its importance as a risk management strategy. Other reports have also indicated the same in the context of adaptation research wherein attitude towards risk of climate change heightens the chances of adoption of alternative practices (Below et al., 2012; Deressa et al., 2011). Nonetheless, the lack of a direct correlation between the readiness and adoption indicates that there are structural constraints which inhibit the implementation. Logistic regression results clearly show that market accessibility is the only factor that is significant and a good predictor of adoption, while the other factors influencing readiness do not necessarily translate to adoption. The difference provides a nice empirical support to the theoretical stance taken by Icek Ajzen (1991) that behavior not only is a function of intention but also dependent on perceived control and external factors. From the behavioural economics perspective, the findings have implications for the impact of uncertainty on decision-making as well. In fact, Daniel Kahneman says, people don't like to take things that have uncertain outcomes, even if they can benefit from them. Uncertainty in terms of market prices, demand and transaction costs also seems to deter farmers to adopt diversified cropping systems as far as agriculture is concerned. A key implication of these results is that adoption cannot be considered as a direct continuation of intention. Instead, it is a separate stage which is defined by structural and institutional conditions. The view is an extension of literature with an addition of a two-stage decision model – preparedness determined by behavioural factors and adoption determined by the market. This argument may also be supported by the relatively low Nagelkerke R 2 value of the logistic model (Nagelkerke R 2 = 0.032). It posits that there are other external factors like infrastructure, policy support, and value chain integration that determine adoption behaviour, but are not comprehensively included in the present model. This reinforces the notion that when making decisions in agriculture, you have to deal with a lot of complexity.

7 Key Findings

The present empirical study provides a delicate picture with respect to the farmer decision making process in the context of crop diversification in hilly region of Uttarakhand. Results indicated that the perception of climate, knowledge and perceived economic gain constitute a significant area of strong preparedness among the farmers to engage in diversification. The descriptive statistics and regression analysis results always conclude that all the variables of awareness, particularly knowledge and perceived benefits, are significant in determining readiness. This suggests that the farmers have known the risks and rewards which may accrue by diversification as a strategy to adapt to climate variability.

The results, however, also indicate that there is no significant relationship between the barriers perceived by the farmers and their readiness to diversify, thus the farmers are psychologically ready to diversify under conditions of constraints. This observation is a sign of change in the traditional notion that intention is directly contraindicated by the structure. Instead, farmers appear willing to consider diversification, but find it difficult to put this thinking into action.

The most severe learning comes out of the logistic regression analysis that indicates that market accessibility is the only statistically significant predictor of actual adoption. Knowledge, benefits and climate perception are factors determining readiness, not implementation. This deviation evidently puts an intention-adoption gap whereby the willingness of farmers to diversify is limited by the external factors.

The findings can be correlated with the theoretical approach by Icek Ajzen (1991) who says that the outcome of behaviour is not only a product of intention but also the perceived control and the situational conditions. Similarly, as described by the knowledge of Daniel Kahneman, uncertainty and the sense of risk can also paralyze action, even though the outcomes are positive. In the present context, there seems to be a high level of influence of uncertainties in the market on the adoption decision-making process.

Overall, the study reveals that the problem of diversification of crops in Uttarakhand is not only due to unawareness or uneagerness but rather structural factors which are primarily linked to the market system.

Policy Suggestions and Recommendations

The study results can be relevant to the agricultural policy and rural development strategies. Existing interventions with the emphasis on the awareness and training may not be a sufficient measure to enhance the diversification, as the intention-adoption gap is apparent. Rather, policy action should deal with structural limitations constraining action.

8.1 Strengthening Market Infrastructure

Since the most important determinant of the adoption level is market accessibility, enhancing the rural market infrastructure should be given a priority. This includes:

1. Rural road and transport network development.
2. Opening of local procurement centres.
3. Farmer-producer organizations (FPOs) promotion.

Through improved market connectivity, transaction costs are minimized and price realisation is improved thus boosting the confidence of farmers to embrace diversified crops. It has been demonstrated that agricultural commercialization and adoption behaviour are greatly enhanced when there is a better market access (Barrett, 2008).

8.2 Ensuring Price Stability and Market Assurance

One of the major discouraging elements to diversification is price uncertainty. Without at least some guaranteed returns, farmers will be less inclined to use new crops. Interventions on policy could involve:

1. Minimum support price (MSP) of diversified crops.
2. Contract farming arrangements
3. Market information systems with real-time price information.

These can reduce the perceived risk and are in line with findings that economic security is an important factor in the adoption decision (Pingali, 2007).

8.3 Strengthening Extension and Advisory Services

Although knowledge is an important part of readiness, it is an indirect influence on the adoption. This implies that the extension services need to be more targeted to close the awareness-implementation gap. There should be efforts to:

1. Demonstration of effective diversification models.
2. Training Farmer on post-harvest management and marketing.
3. Combination of modern practices and traditional knowledge.

The extension systems (FAO, 2016) are the key to knowledge translation into practice.

8.4 Promoting Value Chain Development

When value chains are well developed, diversification stands a better chance of success. Policy should encourage:

1. Storage and processing plant.
2. Development of agricultural sectors industries in the rural regions.
3. Connection of farmers and agribusiness companies.

The development of value chains increases profitability and minimizes post-harvest losses, thus diversification becomes more cost-effective.

8.5 Enhancing Institutional Support and Risk Mitigation

Institutional mechanisms, such as credit facilities, insurance schemes and subsidies, can be adopted to minimize the risk of finance. Availability of cheap credit and crop insurance can assist the farmers to cope with uncertainty and invest in new cropping systems.

8.6 Region-Specific Policy Design

Policies have to be situation-specific and not an all-national policy, since geographical and socio-economic conditions associated with hill agriculture are unique. This involves targeting of the needs of the smallholders, crops that are geographically oriented in terms of terrain and market systems that are localized.

9 Conclusion

This research explored the dynamics of crop diversification in Uttarakhand by differentiating on the behavioural readiness and actual adoption. The results indicate that farmers have a high awareness of climate risks and they have a keen interest in diversification though motivated by knowledge, perceived benefits, environmental awareness.

This is not yet widespread, though. The analysis shows that market accessibility is the key factor that determines implementation meaning that structural conditions are more important determinants of outcomes rather than behavioural factors. This shows that there is intention-adoption-gap, meaning that farmers are willing to do something but there are external barriers which hinder their action.

This analysis serves as an addition to the literature because it suggests two stages in agricultural decision making: intention formation and behavioural implementation. This method gives a more realistic explanation of the behaviour of farmers, especially in areas that have a high level of uncertainty and poor infrastructure.

Policy-wise, the results suggest that policymies trying to improve awareness alone might not have an impact unless combined with market system changes. To enable farmers to effectively make a change to real adoption, market linkages, price stability and risk reduction in transactions are important.

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