STM JOURNALS

Research & Reviews: Journal of
Agricultural Science and Technology

https://journals.stmjournals.com/rrjoast

ISSN: 2278-2206 (Online)
ISSN: 2349-3682 (Print)
Volume 15, Issue 1, 2026
January–April
DOI (Journal): 10.37591/RRJoAST

Review RRJoAST

Psychological Determinants of Farmers' Adoption of Sustainable Practices: A Behavioural Approach to Agricultural Extension

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Abstract

Sustainable agriculture *has emerged as a global priority to balance productivity with environmental conservation. Yet, adoption of sustainable practices by farmers remains uneven, shaped not only by economic incentives but by underlying psychological and behavioural factors. This review explores the psychological determinants influencing farmers' willingness to adopt sustainable agricultural practices across traditional and modern contexts. Drawing upon behavioural theories such as the Theory of Planned Behaviour and the Diffusion of Innovations, the paper analyses how attitudes, perceived behavioural control, risk perception, motivation, emotional intelligence, and social influence affect farmers' decisions. By comparing evidence from India and other regions – Europe, Sub-Saharan Africa, and Southeast Asia – the study highlights that cognitive, affective, and normative factors interact with socio-economic and cultural realities. The review concludes that integrating behavioural insights into agricultural extension can enhance farmers' receptivity toward sustainable innovations, suggesting a paradigm shift from information transfer to psychological empowerment. Furthermore, the review emphasizes the need for context-specific strategies that consider local knowledge systems, peer networks, and community dynamics. Training programs, participatory approaches, and tailored interventions that address farmers' beliefs, values, and emotional capacities are likely to improve adoption rates. Understanding these psychological determinants also helps policymakers and extension agents design more effective incentives and support mechanisms. By highlighting the interplay between human cognition, motivation, and social environment, this study underscores the importance of embedding behavioural approaches within broader agricultural development policies to achieve long-term sustainability and resilience in farming systems.*

Keywords: Adoption behaviour, agricultural extension, behavioural approach, comparative analysis, farmers' attitudes, psychological determinants, sustainable agriculture

INTRODUCTION

The 21st century agricultural landscape faces an unprecedented dual challenge: increasing food production to meet the demands of a growing population while safeguarding environmental resources for future generations. In this context, sustainable agriculture – defined as practices that maintain productivity, preserve ecological balance, and promote socio-economic resilience – has become a central theme in both policy and research. However, the actual adoption of sustainable practices by farmers remains inconsistent, varying widely across regions and even within communities. Traditional explanations, focused on economic constraints or technological access, fail to fully capture the

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Received Date: November 22, 2025
Accepted Date: January 29, 2026
Published Date: March 23 , 2026

Citation: Pallavi Borse. Psychological Psychological Determinants of Farmers' Adoption of Sustainable Practices: A Behavioural Approach to Agricultural Extension . Research & Reviews Journal of Agricultural Science and Technology. 2026; 15(1): 101–109p.

human dimension driving these adoption patterns. Increasingly, scholars and practitioners are recognizing that psychological and behavioural factors play a decisive role in shaping farmers' attitudes toward sustainability (Dessart, et al. 2019) [1].

The behavioural turn in agricultural research acknowledges that farmers are not merely rational economic agents but complex individuals whose decisions are influenced by cognition, emotion, perception, and social context. Studies in agricultural psychology, environmental sociology, and behavioural economics demonstrate that decision-making in farming is deeply embedded in belief systems, perceived norms, and self-efficacy. The success of any agricultural innovation thus depends not only on the technology itself but also on farmers' psychological readiness and motivational alignment with sustainable ideals.

In this paper, the term behavioural approach is employed in a behavioural-psychological sense, rather than as a generic reference to agricultural extension techniques or policy instruments. It is rather agri-behavioural extension perspective grounded in behavioural psychology. Specifically, it refers to the application of psychological and behavioural science theories – including cognition, emotion, motivation, values, perception, and social influence – to explain farmers' adoption behaviour. Agricultural extension and policy frameworks are treated as implementation mechanisms, whereas behavioural psychology constitutes the analytical foundation of this study. This clarification ensures conceptual precision and avoids conflation between behavioural determinants and institutional delivery systems (Deci and Ryan, 2000) [2].

The present review situates farmers' adoption behaviour primarily within agricultural psychology and behavioural science, while acknowledging its applied relevance for extension systems and policy design. Psychological constructs such as attitudes, perceived behavioural control, emotional regulation, values, and risk perception form the core explanatory variables. Extension services are examined as behavioural intervention platforms, and policy incentives are considered contextual moderators rather than primary behavioural drivers. This delineation strengthens conceptual coherence across disciplines.

While behavioural theories originate in psychology, their application in this review is firmly embedded within agricultural decision-making and extension systems. Farmers' cognitive and emotional processes are examined specifically in relation to crop choice, input use, soil and water management, pest control, and climate-responsive practices. Behavioural insights are thus interpreted through the lens of farm-level constraints, agrarian livelihoods, and extension-mediated interactions, ensuring that the analysis remains agricultural in orientation rather than purely psychological.

In countries like India, where smallholder farmers constitute the majority, the psychological determinants of adoption assume even greater significance. Traditional agricultural systems often rely on experiential knowledge, community networks, and cultural continuity, whereas modern systems emphasize efficiency, mechanization, and productivity. Farmers' psychological orientation toward change – encompassing their openness, perceived risk, and locus of control – can either accelerate or hinder the transition toward sustainability. Research has revealed that attitude towards innovation, perceived behavioural control, and subjective norms are strong predictors of technology adoption, as articulated in Ajzen's Theory of Planned Behaviour (TPB). Similarly, Rogers' Diffusion of Innovations Theory underscores that early adopters possess distinct cognitive and motivational traits that influence the wider diffusion process.

Beyond these frameworks, concepts such as emotional intelligence, risk perception, and environmental values have gained attention in understanding sustainable behaviour. Farmers' willingness to experiment with organic inputs, water-saving techniques, or integrated pest management often hinges on emotional regulation, self-efficacy, and trust in institutions. A farmer's

sense of personal responsibility toward nature, combined with optimism and resilience, can shape enduring behavioural change. Conversely, stress, uncertainty, and institutional mistrust can reinforce traditional, risk-averse attitudes.

Globally, studies reveal striking contrasts in these psychological dimensions. In European contexts, farmers' environmental consciousness and access to extension counselling have been major enablers of sustainable adoption. In Sub-Saharan Africa, belief in divine control over nature and economic insecurity often mediate decision-making. In Southeast Asia, collective community norms and peer influence serve as critical motivators. These comparative perspectives illuminate that while psychological variables are universal, their manifestation is context-dependent. The intersection of individual cognition and socio-cultural environment thus becomes the focal point for understanding farmers' adoption behaviour.

The objective of this review is to synthesize the existing literature on psychological determinants influencing sustainable agricultural adoption and to develop a behavioural framework for agricultural extension that goes beyond knowledge dissemination. The paper argues that incorporating behavioural psychology into extension systems can foster more empathetic, farmer-centric approaches that address motivational barriers, cognitive biases, and emotional dynamics. In doing so, it contributes to a holistic understanding of sustainability transitions within both Indian and global agricultural systems.

Review of Literature

The literature on sustainable agricultural adoption has gradually moved from a purely technological and economic orientation to an integrated behavioural perspective. Early studies in agricultural extension emphasised awareness creation, demonstration, and input availability. However, researchers such as Pannell et al. (2006) and Knowler & Bradshaw (2007) [3, 4] found that identical technologies diffused differently across communities, suggesting that psychological factors – attitudes, values, trust, and perceptions – often outweigh structural variables.

In India, several studies have examined farmers' mental and motivational profiles regarding sustainable practices. Singh and Chaudhary (2019) [5] reported that openness to experience, future orientation, and perceived efficacy significantly predicted adoption of integrated pest management in Haryana. Likewise, Pandey et al. (2021) [6] observed that farmers with higher environmental concern and internal locus of control were more willing to adopt organic farming in Madhya Pradesh. These findings reinforce the notion that psychological empowerment and cognitive framing can accelerate behavioural change even in resource-constrained settings.

Globally, research trends mirror these observations. In Europe, where environmental awareness is embedded in policy frameworks, Reimer and Prokopy (2014) [7] demonstrated that farmers' moral obligation toward environmental stewardship strongly influenced conservation behaviour. In Australia and New Zealand, fieldwork by Greiner et al. (2009) [8] showed that risk perception and perceived behavioural control were decisive in the uptake of land-care initiatives. In contrast, studies in Sub-Saharan Africa (Mwangi and Crewett 2020) [9] emphasised social norms and collective efficacy: adoption was higher where group membership or cooperative identity promoted shared responsibility. In Southeast Asia, Nguyen et al. (2018) [10] highlighted community trust and emotional attachment to land as critical predictors, revealing the affective dimension of environmental behaviour.

The role of attitudes has been particularly central. Farmers who perceive sustainable practices as compatible with profitability and tradition tend to adopt them more readily. Conversely, when sustainability is framed as externally imposed or costly, resistance rises. Ajzen's *attitude–behaviour consistency* principle explains these variations: positive attitudes translate into action only when perceived behavioural control and social norms align. Moreover, perceived risk – economic, climatic,

or social – acts as a moderating factor. Farmers often evaluate innovations through experiential heuristics rather than statistical probability, making extension communication that appeals to trust and emotion more effective than purely rational persuasion.

Risk perception, as discussed in this review, is conceptualised as a psychological construct rather than a purely economic or agronomic variable. Unlike objective risk assessments used in climate science or farm economics, psychological risk perception reflects farmers' subjective interpretation of uncertainty, shaped by experience, emotion, trust, and cognitive heuristics (Slovic, 1987; Greiner et al., 2009) [11,8]. Behavioural research consistently shows that farmers rely more on experiential judgement and affective cues than statistical probability when evaluating sustainable innovations, making trust-based and emotionally resonant extension strategies particularly effective. In agricultural contexts, risk perception is closely linked to yield variability, input cost uncertainty, climatic stress, market volatility, and fear of crop failure, rather than abstract probabilistic assessment.

The literature increasingly demonstrates that attitudes, perceived behavioural control, values, and emotional resilience strongly influence adoption behaviour. For instance, Singh and Chaudhary (2019) [5] found that openness to experience and perceived efficacy predicted adoption of integrated pest management in India. Similarly, Pandey et al. (2021) [6] reported that internal locus of control and environmental concern significantly influenced organic farming adoption.

Another cluster of literature explores motivation and values. According to Schwartz's value theory (1992), pro-environmental action stems from self-transcendence values such as benevolence and universalism. Empirical evidence from Germany (Vogt et al. 2015) [12] and Kerala (Thomas 2020) [13] indicates that farmers with strong altruistic and biospheric values engage more in soil and water conservation. Intrinsic motivation – acting out of stewardship or pride – has been found to sustain behaviour longer than extrinsic incentives such as subsidies.

Cognitive appraisal plays a central role in farmers' interpretation of sustainability information. Farmers evaluate innovations through mental models shaped by prior experience, belief systems, and perceived outcomes (Ajzen, 1991) [14]. Emotional processes further mediate these cognitive evaluations. Emotional intelligence enables farmers to regulate anxiety associated with experimentation, cope with uncertainty, and maintain optimism in the face of climatic and economic volatility (Bandura, 1997; Sharma and Borse, 2023) [15, 16]. Emotional self-regulation has been shown to enhance adaptive coping and rational decision-making under stress, thereby facilitating sustainable behavioural change.

Emotional intelligence (EI) has recently entered agricultural discourse. Emotional self-regulation allows farmers to handle uncertainty, crop failures, and peer criticism associated with experimentation. Sharma and Borse (2023) [16] proposed that EI mediates between stress and adaptive coping, enabling rational decision-making in volatile environments. This connection between *affect and cognition* underscores the psychological resilience required for sustainable transformation.Emotional responses in farming are often shaped by crop loss, indebtedness, seasonal uncertainty, peer comparison within villages, and dependence on monsoon cycles, making emotional regulation a critical agricultural competency.

The literature also shows that social influence remains a key behaviorally. Bandura's (1997) [15] concept of *social modelling* suggests that observing successful peers strengthens self-efficacy. Demonstration farms, farmer-to-farmer learning, and participatory field schools utilize this principle effectively. For instance, in Vietnam, collective demonstration plots improved adoption rates of organic rice due to peer endorsement (Tran et al. 2019) [17]. Thus, social learning serves both as a psychological and institutional bridge between innovation and trust.

Table 1. psychological concepts, theories, and extension applications.

Psychological Concept	Theoretical Framework	Core Psychological Mechanism	Application in Agricultural Extension
Attitude	Theory of Planned Behaviour (Ajzen, 1991) [14]	Cognitive evaluation of sustainability benefits	Framing practices as compatible with profitability and tradition
Perceived Behavioural Control	TPB; Self-Efficacy Theory (Bandura, 1997) [15]	Confidence in ability to perform behaviour	Skill-based training, demonstrations, mentoring
Subjective Norms	TPB; Social Learning Theory	Influence of peers and social approval	Farmer groups, peer leaders, participatory learning
Risk Perception	Cognitive–Affective Models (Slovic, 1987) [11]	Subjective interpretation of uncertainty	Trial plots, storytelling, trust-based communication
Values	Value–Belief–Norm Theory (Stern, 2000) [18]	Moral obligation and environmental concern	Stewardship narratives and ethical framing
Emotional Intelligence	Cognitive–Affective Systems	Emotional regulation under stress	Resilience-building and coping interventions
Motivation	Self-Determination Theory	Intrinsic vs extrinsic drivers	Recognition systems and autonomy-supportive extension

Despite these advances, gaps persist. Many extension programs still treat behaviour change as linear information transfer rather than a psychological transformation. Cross-cultural studies reveal that farmers' cognitive frames differ by worldview, religion, and emotional attachment to land. The comparative evidence underscores the need for a context-sensitive behavioural model that integrates cognition, emotion, and socio-cultural identity as shown in table 1.

THEORETICAL FRAMEWORK

Theory of Planned Behaviour

Developed by Ajzen (1991), the TPB posits that behaviour is guided by three components: attitude toward behaviour, subjective norms, and perceived behavioural control. Within agriculture, TPB explains how positive attitudes toward sustainable farming, combined with supportive community norms and perceived ability, predict adoption intention. Empirical validation across continents – India (Pandey et al. 2021) [6], Kenya (Mwangi et al. 2020) [20], and the Netherlands (Reimer and Prokopy, 2014) [7] – shows that intention is a robust precursor to action, provided situational barriers are minimal. Extension agents can enhance each TPB dimension through persuasive communication, peer endorsement, and skill-building exercises.

In agricultural systems, attitudes, norms, and perceived control are shaped through extension advisories, demonstration plots, and farmer-to-farmer learning, which translate behavioural intention into farm-level action.

Diffusion of Innovations Theory

Rogers (2003) [19] classified adopters as innovators, early adopters, early majority, late majority, and laggards. Psychological traits such as openness, risk tolerance, and information-seeking distinguish innovators from others. In sustainable agriculture, innovators often exhibit high self-efficacy and environmental concern. The diffusion process depends on *observability* and *trialability* of practices – attributes that influence farmers' confidence and perceived control. Integrating Rogers' model with TPB clarifies that diffusion is not just social contagion but a sequence of cognitive evaluations.

In agriculture, diffusion is accelerated through progressive farmers, on-field trials, Krishi Vigyan Kendras, and visible yield outcomes, which reduce uncertainty and enhance observability.

Value–Belief–Norm (VBN) Model

Proposed by Stern (2000) [18], the VBN model links values to pro-environmental personal norms

through beliefs about consequences and perceived responsibility. It suggests that moral obligation, rather than profit expectation, can drive sustainable action. Comparative studies show that in Europe, internalized moral norms dominate decision-making, while in India and Africa, collective or religious norms are more salient. Recognising these moral frames allows extension programmes to align sustainability messages with local belief systems.

Among farming communities, values and norms are reinforced through intergenerational land stewardship, cultural attachment to soil, and agrarian identity, strengthening moral commitment to sustainable practices.

Cognitive–Affective Systems Framework

This integrative perspective emphasises interaction between cognitive appraisals and emotional states. Farmers facing climate variability interpret risks through both rational analysis and affective cues – fear, hope, pride. Positive affect enhances openness and experimentation; chronic anxiety fosters conservatism. Training in emotional regulation and problem-solving thus becomes a behavioural tool within extension.

Synthesis of Theoretical Insights

Across models, a few psychological constants emerge

- Attitudes and self-efficacy predict intention.
- Norms and social influence sustain diffusion.
- Values and emotions determine moral commitment.
- Perceived behavioural control bridges intention and action.

A comprehensive behavioural approach must therefore integrate cognitive, emotional, and normative dimensions. Extension strategies that simultaneously inform, motivate, and emotionally engage farmers will likely yield lasting sustainability outcomes.

Behavioural Determinants Across Key Agricultural Practices

The relevance of behavioural determinants becomes particularly evident when examined across specific agricultural practices. Adoption of organic farming requires tolerance for short-term yield variability and confidence in soil health management. Water conservation practices, such as micro-irrigation, are influenced by farmers' perception of initial investment risk and long-term resource security. Uptake of integrated pest management depends on trust in extension advisories and belief in non-chemical efficacy (Tversky and Kahneman, 1974) [20]. Crop diversification and climate-resilient practices demand emotional resilience and openness to experimentation under uncertainty. These examples demonstrate that behavioural factors are not abstract psychological constructs but are embedded within everyday agricultural decision-making, reinforcing the applied relevance of behavioural approaches to sustainable farming.

Comparative Analysis: Global and Indian Perspective

Cross-cultural comparisons reveal that while the psychological foundations of behaviour – attitude, belief, emotion, and social influence – are universal, their expressions are deeply contextual.

In India, the agricultural psyche is anchored in socio-cultural identity and livelihood security. Farmers often perceive the land as sacred and their role as custodians rather than exploiters of nature. Yet, economic uncertainty, input dependence, and fragmented extension services contribute to cognitive dissonance between sustainability ideals and short-term survival imperatives. Studies across states such as Maharashtra, Tamil Nadu, and Punjab indicate that adoption of sustainable practices is most likely when farmers perceive tangible benefits, social approval, and institutional trust. In these contexts, psychological variables – especially risk perception, trust in extension agents, and locus of control – mediate between knowledge and action.

By contrast, European farmers, supported by stable markets and environmental subsidies, tend to exhibit high self-efficacy and intrinsic motivation toward sustainability. Behavioural studies in Germany and the Netherlands demonstrate that adoption decisions are often guided by internalised ecological ethics and positive emotional engagement with environmental stewardship. Farmers perceive sustainability as part of professional pride rather than obligation. Their high perceived behavioural control and supportive policy climate amplify intention–action consistency.

In Sub-Saharan Africa, psychological determinants intertwine with collective identity and community influence. Farmers' decisions often rely on social proof: if respected community members adopt new techniques, others follow. Perceived risk is mediated by social cohesion and shared efficacy rather than individual confidence. Emotional resilience and spirituality also play prominent roles, where belief in divine guidance influences openness to agricultural experimentation.

Southeast Asian contexts (Vietnam, Thailand, Philippines) show an intermediate pattern. Farmers display high environmental awareness but rely heavily on peer validation and practical demonstration before adoption. Attitude toward innovation depends not only on trust in extension agents but also on emotional bonds within farmer groups. Behavioural interventions that leverage social norms – group training, participatory learning – achieve better sustainability outcomes than top-down advisories (Schwartz, 1992) [21].

These comparisons suggest that psychological determinants are multidimensional, blending individual cognition with collective emotion. The relative weight of these factors shifts with socio-economic conditions, policy incentives, and cultural values. Understanding these nuances enables extension systems to adapt strategies rather than replicate universal models.

Implications for Agricultural Extension

From an agricultural standpoint, behavioural insights are most effective when aligned with cropping systems, resource availability, and existing extension infrastructure, rather than treated as abstract motivational tools.A behavioural perspective transforms agricultural extension from a knowledge-transfer system into a human-centred change process. Extension interventions that integrate psychological insights – addressing cognition, emotion, and motivation – are more likely to produce sustained behavioural outcomes than information-heavy approaches alone (Pannell et al., 2006; Reimer and Prokopy, 2014) [3, 7]. Integrating psychological insights can profoundly enhance the effectiveness of sustainability interventions:

Farmer-Centric Communication

Extension workers should tailor messages to farmers' perceptions, emotions, and values. Instead of technical jargon, storytelling, testimonials, and visual cues evoke empathy and trust – essential precursors to behavioural change.

Building Self-Efficacy

Training must focus not only on skill acquisition but also on confidence-building. Demonstration plots, mentoring, and participatory experiments allow farmers to witness success, strengthening perceived control.

Leveraging Social Influence

Extension programmes can strategically identify local opinion leaders as catalysts of change. Peer-led workshops and community radio amplify the persuasive power of relatable models.

Addressing Risk Perception and Emotion

Farmers' hesitation often stems from fear of crop loss or social criticism. Behavioural training that includes emotional regulation, stress management, and decision-making under uncertainty can foster resilience and openness.

Incentivising Intrinsic Motivation

Monetary incentives alone yield short-lived compliance. Recognition systems – awards, public appreciation, "Green Champions" – nurture intrinsic pride in sustainability.

Trust and Relationship Building

Consistent presence and transparent communication by extension agents enhance credibility. Farmers are more likely to act on advice when emotional rapport is established.

Integrating Behavioural Science into Policy

Policymakers should embed behavioural diagnostics within extension programme design. Pre-intervention surveys assessing attitudes, social norms, and perceived control can guide context-specific strategies.

By adopting these principles, agricultural extension can evolve into a psychologically informed movement – transforming sustainability from an external expectation into an internalised commitment (Gross, 1998) [22].

CONCLUSION

This review establishes that the adoption of sustainable agricultural practices is not merely a function of technological awareness or economic rationality; it is profoundly shaped by psychological determinants. Attitudes, perceived behavioural control, values, emotional intelligence, and social influence collectively govern how farmers interpret innovation and risk. Comparative evidence across India, Europe, Africa, and Southeast Asia reveals that while cognition forms the base, emotion and culture provide the context through which sustainability decisions are enacted.

By clearly distinguishing behavioural psychology from extension mechanisms and policy instruments, this review reinforces the conceptual robustness of behavioural approaches in advancing sustainable agricultural adoption. Sustainable transformation in agriculture therefore requires not only improved technologies but also psychologically informed extension systems that nurture confidence, values, and emotional resilience among farmers.

For India, where agricultural transformation is both an economic and moral imperative, integrating behavioural approaches into extension systems can yield transformative results. The path to sustainable agriculture thus lies in nurturing mindsets as much as methods – empowering farmers not only with knowledge but with the confidence, values, and emotional resilience to act upon it. Future research should focus on developing behavioural toolkits for extension professionals, cross-cultural training modules, and participatory psychological assessments to refine the integration of mind and method in agriculture.

By embedding behavioural insights within the realities of crop management, resource constraints, and agricultural extension systems, this review reinforces the centrality of behavioural science to sustainable farming transitions.

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