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Self-efficacy beliefs and their influence on farmer willingness to experiment with novel farming techniques

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Abstract

Some farmers try new techniques eagerly while others resist even when evidence of benefit is clear. What explains this difference? This research examined how self-efficacy beliefs -a farmer's confidence in their own ability to perform a task successfully -influence willingness to experiment with novel farming techniques among 267 smallholder farmers in the Niamey region of Niger. Data were collected through structured interviews between March and August 2023. Results showed that 48.6% of farmers had moderate self-efficacy, 28.7% had low self-efficacy, and only 22.7% scored high. Path analysis confirmed that self-efficacy directly predicted willingness to experiment ($\beta = 0.47$, $p < 0.001$) and indirectly predicted actual experimentation behavior through willingness ($\beta = 0.31$, $p < 0.01$). Farmers who had previously seen successful demonstrations by peers scored 1.3 points higher on self-efficacy than those who had not. Extension contact frequency showed a weaker but significant association ($\beta = 0.19$, $p < 0.05$). The findings suggest that extension strategies should prioritize building farmer confidence through peer demonstrations and small-scale trial plots rather than relying solely on information transfer about new techniques.

Keywords: Self-efficacy, farmer behavior, experimentation, adoption, novel techniques, smallholder farmers, extension strategies, peer learning, behavioral psychology

Introduction

On one side of a village in the Niamey region, a farmer plants drought-tolerant millet on a quarter-hectare trial plot after watching a neighbor's successful harvest. On the other side, a farmer with identical resources refuses the same seed, saying it probably won't work on his soil. The difference between these two farmers is not information - both attended the same extension session. The difference is confidence ^[1].

Bandura's self-efficacy theory ^[2] proposes that people's beliefs about their own capabilities determine whether they attempt new tasks, how much effort they invest, and how long they persist when difficulties arise. In agriculture, self-efficacy has been linked to technology adoption in East Asia and Latin America ^[3, 4], but its role in West African smallholder contexts has received limited attention. Niger's extension system reaches only an estimated 8% of farming households ^[5], making it important to understand which psychological factors amplify or weaken the impact of the limited advisory contact that farmers do receive.

Experimentation -defined here as voluntarily trying an unfamiliar technique on part of one's farm -differs from adoption because it implies willingness to test before committing ^[6]. This distinction matters because many improved techniques require local adaptation that only farmer-level experimentation can provide. This research tested whether self-efficacy beliefs predict farmer willingness to experiment and whether that willingness translates into actual experimentation behavior.

Conceptual model

The research used Bandura's social cognitive theory ^[2] as its primary framework. Self-efficacy is shaped by four sources: mastery experiences (past success), vicarious learning (observing peers succeed), social persuasion (encouragement from trusted others), and physiological states (stress levels). The conceptual model posited that these sources feed into self-efficacy beliefs, which in turn predict willingness to experiment, which then predicts actual experimentation. Extension contact was modeled as a form of social persuasion. A feedback loop was hypothesized from experimentation outcomes back to self-efficacy, reflecting how trial results update confidence.

Material and Methods

Material

A total of 267 smallholder farmers from 18 villages in the Niamey region were selected through multi-stage cluster sampling between March and August 2023. Villages were randomly selected from three communes, and within each village, 14-16 households were sampled from extension registration lists. A structured interview schedule measured self-efficacy using a 10-item scale adapted from Schwarzer and Jerusalem ^[7] (five-point Likert scale), willingness to experiment (four items), and actual experimentation behavior in the preceding two seasons (binary). Demographic and farming characteristics were also collected. Ethical clearance was obtained from the University of Niamey Social Research Ethics Committee (Protocol UN-SREC-2023-015, February 2023).

Methods

Self-efficacy scores were categorized as low (1.0-2.4), moderate (2.5-3.9), and high (4.0-5.0). Path analysis tested the hypothesized model using AMOS 28 with maximum likelihood estimation. Model fit was assessed using CFI, RMSEA, and SRMR. Descriptive statistics and independent-sample t-tests compared self-efficacy by demographic groups. Significance was set at $p < 0.05$.

Pilot research

The interview schedule was pilot-tested with 30 farmers from two non-sampled villages in January 2023. Three self-efficacy items were revised for cultural appropriateness after pilot respondents found the original phrasing abstract. One experimentation item was split into two separate questions to distinguish between trying new crop varieties and trying new cultivation methods. The revised instrument showed acceptable reliability (Cronbach's $\alpha = 0.78$ for self-efficacy, 0.74 for willingness).

Results

Table 1: self-efficacy scores by farmer characteristics (n = 267)

Characteristic	n	Mean SE	SD	p
Gender				
Male	189	3.21	0.87	0.042
Female	78	2.89	0.91	
Peer demo exposure				
Exposed	94	3.62	0.73	<0.001
Not exposed	173	2.81	0.88	
Extension contact				
≥3 contacts/year	71	3.38	0.79	0.011
<3 contacts/year	196	2.94	0.91	

Farmers exposed to peer demonstrations scored significantly higher on self-efficacy (3.62 vs 2.81, $p < 0.001$), with a gap

of 0.81 points -the largest difference observed across all characteristics tested.

Table 2: Path analysis results: standardized coefficients

Path	β	SE	p
Self-efficacy → Willingness	0.47	0.06	<0.001
Willingness → Experimentation	0.38	0.07	<0.001
Self-efficacy → Experimentation (indirect)	0.31	0.05	<0.01
Extension contact → Self-efficacy	0.19	0.07	0.038
Peer demo exposure → Self-efficacy	0.36	0.06	<0.001

Model fit was acceptable: CFI = 0.94, RMSEA = 0.056, SRMR = 0.048. Self-efficacy was the strongest predictor of willingness to experiment ($\beta = 0.47$), and peer

demonstration exposure was the strongest predictor of self-efficacy ($\beta = 0.36$).

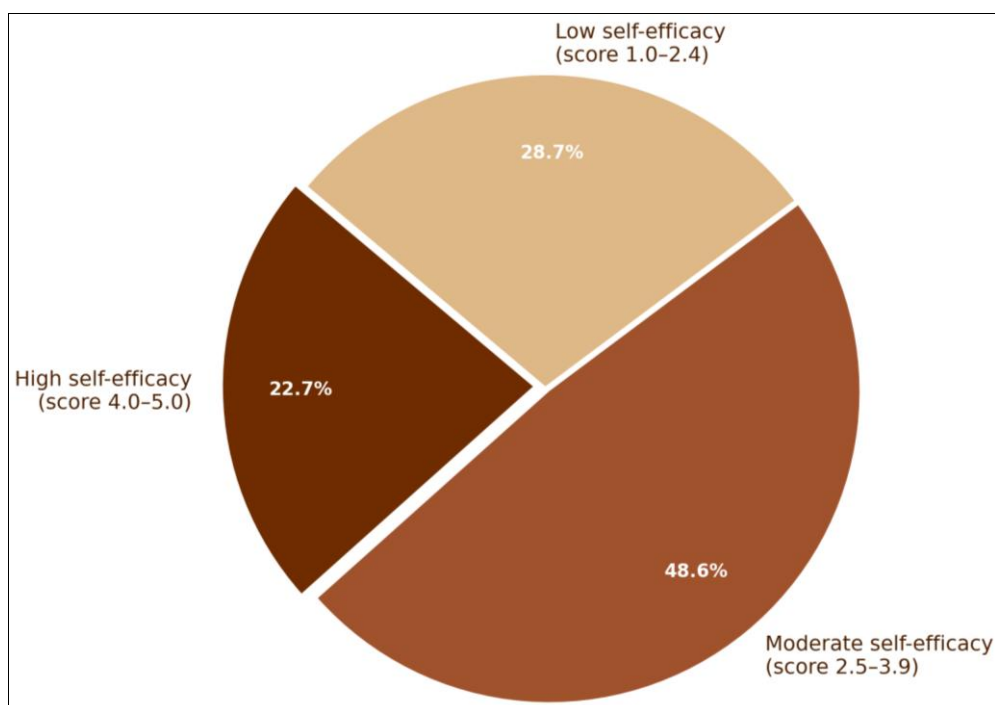


Fig 1: Distribution of self-efficacy levels among farmer respondents

Nearly half the sample (48.6%) fell in the moderate range, while only about one in five farmers (22.7%) reported high self-efficacy. The low-efficacy group (28.7%) represents the

segment most likely to resist experimentation regardless of information access.

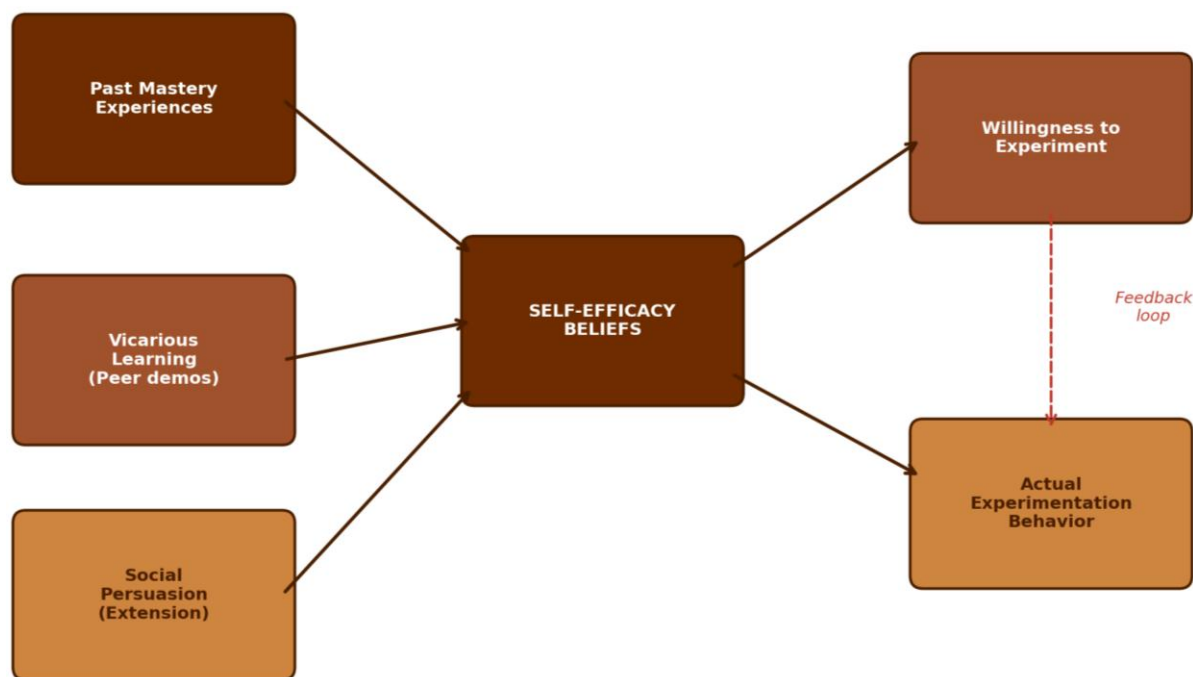


Fig 2: Conceptual pathway from self-efficacy sources to experimentation behavior

Three sources feed self-efficacy: mastery experiences, vicarious learning through peer demonstrations, and social persuasion through extension contact. Self-efficacy then predicts willingness, which predicts actual experimentation. The dashed line shows the feedback loop from experimentation outcomes back to self-efficacy.

Discussion

The strong path from self-efficacy to willingness ($\beta = 0.47$) confirms Bandura's prediction that confidence is a gateway to action [2]. Interestingly, peer demonstration exposure influenced self-efficacy almost twice as strongly as extension contact ($\beta = 0.36$ vs 0.19), suggesting that seeing a neighbor succeed is a more powerful confidence builder than hearing an agent explain a technique [8]. This has direct implications for extension strategy: investing in farmer-to-farmer demonstration networks may yield better returns than increasing the frequency of conventional advisory visits. The finding that women scored lower on self-efficacy aligns with gender research in West African agriculture showing that women face additional barriers to trying new practices including limited land control and restricted mobility [9]. Extension programs targeting women should include explicit confidence-building components such as women-only trial groups and female lead farmer mentorship [10]. The cross-sectional design limits causal inference, and self-reported experimentation may overestimate actual behavior. The sample was restricted to one region, and results may differ in more remote areas with less extension access.

Limitations

The cross-sectional design prevents confirming the causal direction of the self-efficacy-experimentation relationship. Self-reported behavior measures may be subject to recall

bias. The sample covered only the Niamey region, limiting generalizability to other agro-ecological zones in Niger. The feedback loop from experimentation back to self-efficacy could not be tested without longitudinal data.

Conclusion

Self-efficacy beliefs emerged as a strong predictor of farmer willingness to experiment with novel farming techniques in Niger. Farmers who watched peers successfully demonstrate new methods showed markedly higher confidence than those who relied on extension advice alone. These results argue for shifting extension strategy from an information-centered model to a confidence-centered one. Small-scale trial plots, peer demonstration networks, and graduated risk exposure can build the self-efficacy that transforms interest into action. Extension services that measure and target farmer confidence alongside farmer knowledge will likely see higher experimentation rates and, eventually, more sustainable adoption of improved practices.

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