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PASSION FOR THE FARMING AND INNOVATION: THE MEDIATING ROLE OF WORK ENGAGEMENT BETWEEN PSYCHOLOGICAL EMPOWERMENT AND INNOVATIVE WORK BEHAVIOR

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Abstract
Farmers must innovate to adapt to ongoing changes; however, many are becoming psychologically powerless, and farming is increasingly viewed as an unattractive profession among younger generations. This study examined the mediating role of work engagement between psychological empowerment and innovative work behavior among farmers, as well as differences in these variables between younger and older farmers. Data were collected from 403 participants using validated scales for the three variables. Analyses were conducted using Partial Least Squares Structural Equation Modeling (PLS-SEM) with SmartPLS 4.1.12 and the Mann–Whitney U test.
The results indicate that psychological empowerment significantly influences both work engagement and innovative work behavior. Work engagement, however, does not significantly influence innovative work behavior and therefore does not function as a mediator. The predominantly top-down pattern of innovation dissemination from extension agents to farmers appears to be a key reason for the lack of a mediating effect. Although innovation is externally introduced, farmers' engagement emerges as a consequence of implementing these innovations rather than as a driver of innovative behavior. These findings suggest that top-down and bottom-up approaches to promoting innovative work behavior have different impacts on work engagement. Prior studies conducted in bottom-up contexts have shown that work engagement mediates psychological empowerment and innovative work behavior; workers who already value their work tend to show greater innovation. In contrast, in this study, innovation was provided by extension agents, making work engagement an outcome rather than a mediator.
The study also found that younger farmers exhibit higher levels of psychological empowerment, work engagement, and innovative work behavior compared to older farmers. Interventions are therefore needed for older farmers—particularly those aged 40–50 years—to enhance these three variables. Although younger farmers show higher quality in these areas, their numbers remain limited. As such, efforts to increase young people's interest in farming are crucial. Creating a bottom-up innovation environment may be one effective strategy for fostering such interest.
Keywords: psychological empowerment; innovative work behavior; work-engagement; farmer.

INTRODUCTION

Innovation is an essential prerequisite for sustainable agriculture (Rosario et al., 2022). Farmers must

innovate to respond to changes in the environment, climate, society, the economy, and technological development. Agricultural research has produced various findings regarding innovations related to agricultural products and farmers' incomes (de Oca, 2021). However, these studies have not examined innovation as a behavior inherent within farm workers. Janssen (2000) introduced the concept of innovation as an inherent worker behavior consisting of three phases: idea generation, idea promotion, and idea realization. This concept is widely known as Innovative Work Behavior. Earlier, Scott and Bruce (1994) defined Innovative Work Behavior as the effort to communicate, demonstrate, and promote new ideas at work. Similarly, Jong and Hartog (2010) described it as a series of gradual behaviors, beginning with idea creation, followed by the advocacy of the idea, and ending with its implementation. A substantial body of research has examined Innovative Work Behavior from this perspective, particularly among workers in the service and manufacturing sectors (Koroglu et al., 2022; Alshamsi et al., 2023). However, only a limited number of studies have explored Innovative Work Behavior in the context of farmers. Research involving farmers has generally focused on the effects of technological innovations in agriculture on production outcomes or sales performance of agricultural products.

Farmers' innovative work behavior has become an important issue in sustainable agriculture, as it involves a continuous series of innovations required to meet human food demands while maintaining environmental and ecological sustainability (Contreras-Medina et al., 2025). Various agricultural innovations have been developed and disseminated to farmers (Rizzo et al., 2024; Salembier et al., 2021), yet they provide limited insights into farmers' innovative work behavior. Previous studies have not positioned farmers as the central subjects of innovation; instead, they focused on specific farming techniques as innovations that influence agricultural outcomes (Rizzo et al., 2024; Salembier et al., 2021). Agricultural innovations have tended to follow a top-down model, initiated by governments or research institutions and delivered to farmers through extension agents (Sofia, Suryaningrum, & Subekti, 2022). Consequently, farmers have often remained passive recipients of innovation-related information, applying innovations developed by others. This study shifts the focus beyond innovative farming techniques to include the actors who generate innovation. Farmers are viewed not as passive receivers but as active agents who, through their daily work, can produce innovation. Therefore, this study aims to assess the extent to which farmers possess the potential to exhibit innovative work behavior.

Farmers exhibit innovative work behavior when they are fully engaged in their work. Their commitment is reflected not only physically—by visiting their fields every day—but also psychologically through the attention and thought they devote to the crops and livestock they cultivate. Farmers often develop a deep affection for their work. This attitude is referred to as work engagement, which is defined as a physical, emotional, and cognitive attachment to one's work (Koroglu et al., 2022; Alshamsi et al., 2023; Palumbo, 2021). When farmers lack passion for their work and do not devote adequate attention to it, they may struggle not only to implement innovations but also to generate them. Such a disengaged attitude can eventually lead them to abandon their agricultural activities in favor of other occupations they perceive as more rewarding (Arvianti et al., 2019). One factor that influences work engagement is psychological empowerment, a psychological state in which individuals feel powerful, competent, and confident in performing their tasks and

believe that their roles produce meaningful impacts and benefits for themselves and their communities. Many farmers, however, experience a sense of powerlessness (Aminah et al., 2015). Evidence shows that they often depend on government subsidies, such as assistance for procuring fertilizers and supporting innovation and technological development (Aminah et al., 2015).

A growing body of research demonstrates a close relationship among work engagement, innovative work behavior, and psychological empowerment. Innovative work behavior is influenced by work engagement (Koroglu et al., 2022; Alshamsi et al., 2023; Palumbo, 2021); work engagement, in turn, is influenced by psychological empowerment (Meng et al., 2019; Monje-Amor et al., 2021; Sun et al., 2022); and innovative work behavior is also directly influenced by psychological empowerment (Bantha & Nayak, 2020; Javed et al., 2019; Ali et al., 2020). However, no study has examined work engagement as a mediating variable between psychological empowerment and innovative work behavior. Furthermore, no research has tested a model that integrates the three variables with work engagement as a mediator, including in agricultural contexts. Due to the limited understanding of how these constructs interact among farmers, further studies are needed to obtain a clearer picture of farmers' innovative work behavior, work engagement, and psychological empowerment.

Exploring the dynamics of innovative work behavior, work engagement, and psychological empowerment among Indonesian farmers is particularly relevant because younger generations have recently shown a declining interest in pursuing farming as a profession (Arvianti et al., 2019). Farming is no longer viewed as a primary, prestigious occupation; instead, younger individuals perceive it as supplemental work (Arvianti et al., 2019). Agricultural census data collected by the National Statistics Agency in 2023 indicate that young farmers constitute only 21.93% of the total, compared to 35.32% among those aged 40–54 years and 42.75% among those aged 55 years and above. Younger generations are less interested in farming because they perceive it as manual labor with unstable income, and many lack access to land due to rising land prices. They tend to pursue professions that offer easier entry and align with more urban-oriented lifestyles (Qonita et al., 2025). This generational discontinuity poses a serious threat to the sustainability of agriculture, potentially leading to stagnation and hindering agricultural development. Cross-generational farming has thus become an important issue. Consequently, this study does not only examine work engagement as a mediator between psychological empowerment and innovative work behavior, but also compares the dynamics of these three variables between two farmer groups: older and younger farmers.

Older and younger farmers generally exhibit different characteristics. Younger farmers aged 19–39 years tend to have higher levels of education, broader networks, and greater responsiveness to new technologies and information that support farm development. They also demonstrate stronger learning motivation and higher levels of innovativeness (Noviva & Iskandar, 2022). In contrast, older farmers are often perceived as more traditional, relying on conventional methods and being less receptive to technological change (Qonita et al., 2025). Nevertheless, no existing data have compared these two generations in an apple-to-apple manner. Beyond understanding the cross-generational model of innovative work behavior, this study aims to compare the innovative work behavior, work engagement, and psychological empowerment of both groups to determine which group requires more targeted interventions to sustain farmer regeneration in Indonesia.

MATERIAL AND METHODS

Research Location and Period

This study employed a quantitative survey method to obtain both descriptive and analytical data. The research was conducted in Sikka District from August 2024 to June 2025. The region is characterized by the presence of older farmers as well as younger generations who have increasingly shifted away from agricultural activities toward alternative occupations, such as working as motorcycle taxi drivers or migrating to other regions for employment.

Population and Sample

The population of this study consisted of farmers aged 18 years and older residing in Sikka District, East Nusa Tenggara Province, who were listed in the Agriculture Office database. These farmers represented various types of agricultural activities and generational groups. According to the Statistics Agency of East Nusa Tenggara Province, the number of farmers in Sikka Regency was 53,688 (BPS NTT, 2023). Stratified Random sampling was used to determine the sample size. Using the Slovin formula—$n = N / (1 + N(e^2))$—and applying a 5% margin of error, the sample size was calculated as $53,688 / [1 + 53,688(0.05^2)] = 397$, which was rounded to 400 participants. The final sample comprised 106 young farmers aged 18–39 years and 297 older farmers aged 40 –70 years, resulting in a total of 403 participants.

Data Collection Techniques

Data were collected using a modified version of the Psychological Empowerment Scale by Pedro et al. (2023), the Utrecht Work Engagement Scale (UWES) developed by Schaufeli and Bakker (2004), and the Innovative Work Behavior Scale adapted from Ayoub et al. (2023). The Psychological Empowerment Scale consists of 12 items rated on a 7-point Likert scale ranging from 1 (“strongly disagree”) to 7 (“strongly agree”). The Work Engagement Scale consists of 17 items rated on a 7-point Likert scale ranging from 1 (“never”) to 7 (“every day”). The Innovative Work Behavior Scale consists of 27 items rated on a 5-point Likert scale ranging from 1 (“not appropriate”) to 5 (“very appropriate”). This study employed three latent variables: psychological empowerment as the exogenous latent variable; work engagement as the endogenous latent variable functioning as a mediator; and innovative work behavior as the endogenous (dependent) latent variable.

Data Analysis

Data were analyzed using the Partial Least Squares Structural Equation Modeling (PLS-SEM) approach with SmartPLS version 4.1.1.2. The analysis process comprised three main phases: evaluation of the measurement model (outer model), evaluation of the structural model (inner model), and assessment of model fit and overall goodness of fit.

The first phase, measurement model evaluation, included assessments of convergent validity, discriminant validity using the Fornell–Larcker criteria and the Heterotrait–Monotrait Ratio (HTMT), and composite reliability. The second phase, structural model evaluation, involved examining the inner VIF, direct effect results, and effect size (f^2). The third phase included evaluating goodness-of-fit and model fit using the R^2, Q^2, Standardized Root Mean Square Residual (SRMR),

and PLS Predict values. Comparisons between young and older farmers were conducted using the Mann–Whitney U test.

RESULTS AND DISCUSSION

The study involved two groups of farmers: young farmers and older farmers. The sample consisted of 106 young farmers (26.3%) and 297 older farmers (73.7%). Regarding gender, the young farmer group included 50 men (47.2%) and 56 women (52.8%), while the older farmer group included 166 men (55.9%) and 131 women (44.1%). In terms of educational background, most participants had completed elementary school (n = 188, 46.6%), followed by junior high school (n = 88, 21.8%), high school (n = 115, 28.5%), package C equivalency education (n = 1, 0.2%), and a bachelor's degree (n = 37, 9.2%). This distribution indicates that although most farmers had basic education, there is an increasing trend of participation from younger individuals with higher educational attainment in the agricultural sector.

This study included three latent variables: psychological empowerment (exogenous), work engagement (endogenous mediator), and innovative work behavior (endogenous dependent). These variables were used to examine causal relationships, including both direct and indirect effects within the research model. Table 1 presents the latent variables and their associated items along with the mean values.

Table 1. Latent variables and research indicators

Variable	Item	Mean
Psychological Empowerment (X)	X1: Being a farmer is meaningful for me.	6.521
	X2: Farming activities are important for me.	6.459
	X3: Personally, farming activities are meaningful for me.	6.506
	X4: I am confident to farm.	6.464
	X5: I am able to farm.	6.464
	X6: I have the skills to farm.	6.290
	X7: I am free to determine how I work in farming land.	6.409
	X8: I can independently determine what I do in the field and garden.	6.357
	X9: I still have options regarding what I handle my harvests.	6.427
	X10: I have significant influence on other farmers.	6.221
	X11: I have substantial control over what happens in my field.	6.231
	X12: I have a meaningful influence on fellow farmers.	6.270
Work Engagement	Y1: When working, I feel full of energy. *	6.620
	Y2: I feel that the work I do has purpose.	6.526
	Y3: Time passes quickly when I am working.	6.397
	Y4: I feel strong and enthusiastic when working.	6.538
	Y5: I am enthusiastic about my work.	6.462

	Y6: When I work, I forget everything around me. *	6.221
	Y7: My work inspires me. *	6.670
	Y8: When I wake up in the morning, I feel like going to work.	6.486
	Y9: I feel happy when I work intensively.	6.479
	Y10: I am proud of the work I do.	6.476
	Y11: I become absorbed in my work.	6.196
	Y12: I can work for a very long period of time.	6.293
	Y13: My work is challenging for me. *	5.695
	Y14: I get carried away when working.	6.241
	Y15: I persevere in completing my work. *	6.285
	Y16: It is difficult to detach myself from work. *	5.809
	Y17: I remain diligent even when things do not go well. *	5.811
Innovative Work Behavior	Z1: I can develop ideas and solutions creatively when my crops face problems. *	
	Z2: I share ideas with fellow farmers or extension agents regarding agricultural issues.	4.499
	Z3: I share ideas with farmers or extension agents about opportunities to solve crop problems.	4.536
	Z4: I discuss with farmers or extension agents the potential to change work patterns for better results.	4.447
	Z5: I propose new ideas for development in the farmer group.	4.300
	Z6: I can express my opinions on basic agricultural problems.	4.397
	Z7: I discuss my ideas for improving farming with other farmers.	4.409
	Z8: I share ideas about real changes in my cultivated land with colleagues.	4.270
	Z9: I suggest improvements to ideas proposed by farmers or extension agents.	4.414
	Z10: I can convince others of the importance of better ideas or new solutions.	4.377
	Z11: I propose new ideas to stakeholders who allocate resources (government, legislators, NGOs).	4.395
	Z12: I promote new ideas to extension agents.	4.189
	Z13: I promote other farmers' new ideas.	4.298
	Z14: I introduce fellow farmers to new ideas or approaches.	4.253

Z15: I illustrate how a new idea can be applied gradually and practically to other farmers.	4.357
Z16: I test solutions for unexpected agricultural problems.	4.186
Z17: I analyze the unintended effects of applied agricultural solutions.	4.362
Z18: I monitor progress during the implementation of solutions to agricultural problems.	4.372
Z19: I identify success criteria for implementing my ideas.	4.380
Z20: I provide information to other farmers regarding progress on my ideas.	4.318
Z21: I think critically about existing procedures when agricultural ideas are applied.	4.395
Z22: I design practical strategies to solve agricultural problems.	4.236
Z23: I compare the outcomes of proposed ideas with previously established goals.	4.285
Z24: I work with farmers to further develop ideas I have introduced.	4.377
Z25: I initiate collaboration with other groups to implement new ideas.	4.407
Z26: I discuss with farmers how to apply ideas within the agricultural system.	4.360
Z27: I am aware of the steps needed to implement my ideas in agriculture.	4.360

Note: marked * = the item is not valid

Evaluation of the Measurement Model (Outer Model)

The evaluation of the reflective measurement model involves several steps. First, validity is assessed through the external loading values, also known as factor loadings (LF). An LF value of at least 0.70 is considered acceptable (Hair et al., 2021). The LF value represents the amount of variance in an item explained by its corresponding construct. Convergent validity is then assessed using the average variance extracted (AVE), which should be at least 0.50, along with Cronbach's alpha and composite reliability (CR), both of which should be at least 0.70 (Hair et al., 2021).

Unlike Cronbach's alpha, CR is an internal consistency reliability measure that does not assume equal indicator loadings. AVE indicates the degree to which a latent construct explains the variance of its indicators. The next step is to assess discriminant validity, which ensures that the constructs included in the model are statistically distinct from one another. Discriminant validity can be evaluated using the Fornell–Larcker criterion, which compares the square root of each construct's AVE to its correlations with other constructs (Hair et al., 2022).

Discriminant validity is considered adequate when the square root of the AVE exceeds the inter-construct correlations (Hair et al., 2022). Additionally, the Heterotrait–Monotrait Ratio (HTMT) should be below 0.90 to indicate acceptable discriminant validity (Henseler et al., 2015). HTMT represents the average of correlations between indicators of different constructs relative to the geometric mean of correlations among indicators measuring the same construct (Hair et al., 2022). For formative measurement models, the evaluation involves examining the significance of external weights (path coefficients), with p values less than .05, and confirming the absence of multicollinearity. This is indicated by an external variance inflation factor (VIF) of less than 5 (Hair et al., 2017). VIF reflects the extent of collinearity among indicators in the formative measurement model (Hair et al., 2022).

The first stage of analysis in this study was the evaluation of the outer model. Indicators were considered valid if their external loading values exceeded 0.70. The external loadings ranged from 0.713 to 0.952, indicating strong correlations between the indicators and their respective constructs. The results of this evaluation are presented in the following figure 1.

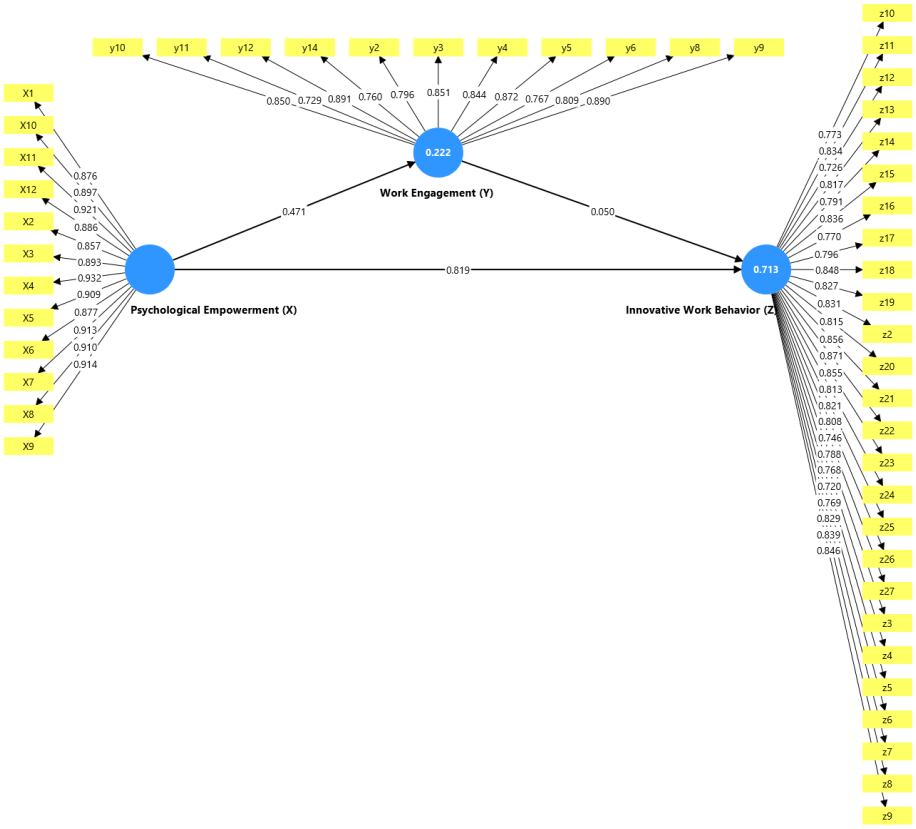

Figure 1. Overall Outer loading and path coefficient

The second stage of evaluation focused on assessing the reliability of each construct. Reliability was examined using Cronbach's alpha, composite reliability (rho_A), and composite reliability (rho_C). All estimates exceeded the recommended threshold of 0.70, indicating satisfactory internal consistency (Hair et al., 2022). These results demonstrate that each indicator consistently measured its corresponding construct. The reliability values for all measurement variables are presented in Table 2.

Table 2. Reliability level of overall measurement variables

Variable	Cronbach's alpha	Composite reliability (rho_a)	Composite reliability (rho_c)
Psychological Empowerment (X)	0.978	0.979	0.981
Work Engagement *(Y)*	0.953	0.956	0.959
Innovative work behavior (Z)	0.979	0.980	0.980

The third evaluation involved assessing convergent validity using the average variance extracted (AVE). An AVE value greater than 0.50 is considered acceptable (Hair et al., 2017). All study variables—both for the young and older generational groups—had AVE values above 0.50, indicating adequate convergent validity, as shown in Table 3.

Table 3. AVE Table

Variable	Average Variance Extracted (AVE)
Psychological Empowerment (X)	0.808
Work Engagement (Y)	0.681
Innovative Work Behavior (Z)	0.654

The AVE values for psychological empowerment (X), work engagement (Y), and innovative work behavior (Z) reflect the proportion of indicator variance explained by each construct. Because the AVE values for all three variables exceeded 0.50, each construct demonstrated strong convergent validity. This means that the indicators effectively represented their intended constructs and accounted for a substantial portion of variance. Consequently, these findings reinforce the reliability of the measurement model and confirm the appropriateness of the variables for further analysis.

The fourth evaluation assessed discriminant validity using the Fornell–Larcker criterion. According to this criterion, a construct demonstrates adequate discriminant validity when the square root of its AVE is greater than its correlations with other constructs (Hair et al., 2022). In the Fornell–Larcker matrix, the diagonal values represent the square root of the AVE, while the off-diagonal values reflect inter-construct correlations. The results, presented in Table 4, show that each construct met this criterion, confirming discriminant validity for all variables across groups.

Table 4. Fornell and Lacker

	Psychological Empowerment (X)	*Work engagement* (Y)	Innovative Work Behavior (Z)
Psychological Empowerment (X)	0.899		
Work Engagement (Y)	0.471	0.825	

Innovative Work Behavior (Z)	0.843	0.436	0.808

The Fornell–Larcker evaluation showed that the square root of the AVE for each variable—both in the aggregate sample and within each generational group—was greater than its correlations with other variables. Therefore, the discriminant validity of all constructs was confirmed.

Discriminant validity was further examined using the Heterotrait–Monotrait Ratio (HTMT). According to Henseler et al. (2015), HTMT values below 0.90 indicate acceptable discriminant validity. The results showed that all construct pairs had HTMT values below 0.90 for both the aggregate sample and the generational subgroups. Therefore, discriminant validity was confirmed based on HTMT as well. The HTMT results are presented in Table 5.

Table 5. Overall HTMT

	Psychological Empowerment (X)	Work Engagement (Y)	Innovative Work Behavior (Z)
Psychological Empowerment (X)			
Work Engagement (Y)	0.481		
Innovative Work Behavior (Z)	0.856	0.442	

Structural Model Evaluation (Inner Model)

The structural model evaluation in PLS-SEM begins with assessing multicollinearity among the constructs, both for the aggregate sample and the generational groups. Multicollinearity is evaluated using the internal Variance Inflation Factor (VIF). A VIF value below 5 indicates low or negligible multicollinearity. As shown in Table 6, all internal VIF values were below 5, demonstrating that multicollinearity was minimal or absent. This suggests that the parameter estimates of the PLS model are valid and not biased by collinearity issues (Hair et al., 2022).

Table 6. Inner VIF

	VIF
Psychological Empowerment (X) -> Work engagement (Y)	1.000
Psychological Empowerment (X) -> Innovative work behavior (Z)	1.285
Work engagement (Y) -> Innovative work behavior (Z)	1.285

The next step was to test the direct effects between constructs for both the aggregated data and the generational groups. A direct effect is considered statistically significant when the t-value exceeds 1.96 or the p-value is less than .05. These tests were conducted using the bootstrapping procedure in PLS-SEM, and the results are displayed in Table 7.

Table 7. Direct effect analysis outcomes

	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics (|O/STDEV|)	P values	Description
Psychological empowerment (X) -> Work engagement (Y)	0.471	0.476	0.036	13.170	0.000	Significant
Psychological empowerment (X) -> Innovative work behavior (Z)	0.819	0.820	0.030	26.929	0.000	Significant
Work engagement (Y)-> Innovative work behavior (Z)	0.050	0.049	0.038	1.325	0.185	not Significant

Psychological Empowerment (X) → Work Engagement (Y)

The results of this study indicate that psychological empowerment has a significant effect on farmers' work engagement. In agricultural settings, empowered farmers perceive their work as meaningful. Farming is not merely a routine activity but a vocation embedded in the relationship between humans, nature, and the surrounding social environment. Empowered farmers are deeply committed to cultural values. They do not view plants and nature as passive objects to be manipulated; rather, they consider them as living entities that contribute to life. Thus, farming is regarded not as an ordinary profession but as a noble calling that connects farmers to nature and to their ancestors, reflecting a sacred responsibility to care for both land and life (Ton, 2023). This interpretation of farming as meaningful work aligns with the dimensions of work engagement—particularly enthusiasm, vigor, and absorption, often described as "losing track of time" while working. These findings are consistent with research conducted in other countries showing that farming activities extend beyond food production; they reflect the warm relationship between farmers, nature, and the community, generating a strong sense of meaning and purpose (Ton, 2023). Farmers often take pride not only in abundant harvests but also in fulfilling and preserving agricultural traditions, which are viewed as life rituals with spiritual significance (Ton, 2023).

Farming also represents a continuous learning process that requires ongoing skill development. Empowered farmers immerse themselves in farming activities and seek to improve their competencies, perceiving farming as an enjoyable learning experience (Charatsari et al., 2025). Learning in agriculture involves acquiring new skills and adapting to climate and environmental changes. This illustrates why competence, as a dimension of psychological empowerment, contributes substantially to work engagement.

Self-determination is another key characteristic of empowered farmers. Charatsari et al. (2025) found that farmers with strong self-determination spend more time learning independently to acquire new knowledge and enhance their skills, whereas farmers with low self-determination tend to participate in learning activities only when external rewards, such as fertilizer subsidies or assistance, are offered. These findings correspond with the present study, which shows that self-determination is positively associated with work engagement—particularly enthusiasm and persistence in performing daily farming tasks.

Another dimension of psychological empowerment is the perception of making a positive impact on others. Empowered farmers recognize that their actions affect not only their families but also the community and the environment. Previous studies have shown that the sense of contributing to others, the community, and nature enhances farmers' commitment and dedication to their agricultural activities (Prabowo & Sudrajat, 2021; Toansiba et al., 2021; Ton, 2023). Feeling that their work has meaningful impacts strengthens farmers' motivation and engagement in sustaining and improving their farming practices.

Psychological Empowerment (X) → Innovative Work Behavior (Z)

The results of this study also demonstrate that psychological empowerment influences farmers' innovative work behavior. This relationship is logical because innovative behavior can be understood as a manifestation of an empowered farmer's mindset. Farmers who exhibit innovative work behavior consistently seek opportunities to develop new ideas. Novel ideas often emerge from practical challenges encountered throughout planting, cultivation, and marketing processes (McKenzie et al., 2024). Once problems are identified, empowered farmers attempt to resolve them through experimentation and the implementation of new methods. Research on agricultural innovation emphasizes that innovation is most effective when farmers are empowered, actively involved, and have a voice in the innovation process (Cofre-Bravo et al., 2019).

When farmers discover effective solutions, they often share these innovations with others. This finding is consistent with research by Heliawati et al. (2020), which shows that innovative farmers tend to form social networks, build mutual trust, and engage in reciprocal knowledge sharing. Empowered farmers with higher competence and knowledge are more likely to disseminate innovative practices to fellow farmers. Li et al. (2024) reported similar findings, showing that competence—one of the dimensions of psychological empowerment—plays a crucial role in shaping innovative work behavior. Competence is especially important in the context of agricultural technologies, as demonstrated by Sandhu et al. (2024), who found that technological competence enhances farmers' ability to adopt and utilize digital tools for agricultural innovation.

Self-determination, another dimension of psychological empowerment, is often reflected in the willingness to make independent decisions (Spreitzer, 1995). Research among women farmers indicates that those with strong decision-making autonomy exhibit more innovative behavior (Shabaz et al., 2022). Other studies show that farmers often make independent and sometimes risky decisions to pursue innovation because risk-taking is essential for adaptation to dynamic environmental conditions (Kangogo et al., 2021). This study also found that farmers who work alone, without collaboration with other farmers, experience negative effects when implementing

agricultural innovations. These findings implicitly suggest that feeling able to influence others—a dimension of psychological empowerment—positively contributes to innovative work behavior (Caffaro et al., 2019).

The sense of having an impact is one dimension of psychological empowerment that is manifested through idea champion behavior, which constitutes one of the key dimensions of work innovation behavior. Scholars argue that work innovation represents an effort to transfer knowledge through networking among agents in the agricultural sector (Röling & Jiggins, 1998). Empirical studies on farmer innovation largely demonstrate that innovation emerges from learning processes—either from other agents or farmers, or from farmers' own learning processes that are subsequently transferred to other farmers. These processes form both linear and circular sequences, which may begin with extension agents and continue from one farmer to another, or originate from farmers and then be relayed back to extension agents before being disseminated further (Salembier et al., 2021; Charatsari et al., 2025). Each actor in the agricultural system plays a distinct role: some generate innovative ideas, others realize them, disseminate them, or further develop them (Oreszczyn, Lane, & Carr, 2010). Farming behavior itself reflects a form of human work innovation behavior expressed in managing nature and the environment through learning processes—individually or collectively—within networks of information exchange that encompass both agricultural knowledge and skills (Pradesti et al., 2024). Thus, a key element of work innovation behavior is the transfer of knowledge and skills that produce meaningful impact. This explanation indicates that the sense of having an impact, as a dimension of psychological empowerment, influences work innovation behavior because work innovation behavior is, in essence, an expression of the attitudes embedded within psychological empowerment itself.

Work Engagement (Y) → Innovative Work Behavior (Z)

The results of this study indicate that work engagement does not influence farmers' innovative work behavior. This finding contrasts with previous studies that suggest a strong emotional connection or passion for one's work promotes higher levels of innovation. Several explanations may account for this discrepancy.

First, the farmers in this study were members of farmer groups supervised by extension agents, which tended to create a passive learning environment. Innovations introduced within these groups were primarily top-down, meaning that farmers often implemented innovations because they were instructed to do so by extension agents rather than because they generated the ideas themselves. Although the farmers displayed high levels of engagement—such as enthusiasm, dedication, and enjoyment to the point of losing track of time—this engagement occurred within a structure where innovative ideas originated externally. As a result, their innovative behavior consisted largely of applying existing innovations rather than developing new solutions based on their own insights (Sofia et al., 2022; Singh et al., 2025).

This explanation aligns with research showing a decline in farmers' local knowledge related to cultivation practices across different regions (Prabowo & Sudrajat, 2021; Toansiba et al., 2021; Jawan et al., 2025). The type of innovation measured in this study focused on the creation of new ideas and solutions, not simply the application of existing techniques. When innovation is externally

driven and does not require creativity from the farmers themselves, work engagement is unlikely to translate into innovative work behavior. The dominance of extension agents and the top-down nature of innovation programs (Sofia et al., 2022; Singh et al., 2025) may unintentionally inhibit farmers from developing their own innovations despite their discipline, dedication, and commitment. In such contexts, farmers may be enthusiastic about implementing innovations, but not about generating new ones.

Previous studies also show that the majority of farmers' knowledge is inherited from ancestral practices and passed down across generations, requiring application rather than creation of new methods (Prabowo & Sudrajat, 2021; Toansiba et al., 2021; Jawan et al., 2025). Only a small proportion of farmers engage in genuine innovation. Where farmer-driven innovation does occur, it typically originates either from extension agents or from long-standing cultural knowledge rather than from individual creative processes. Thus, the farmers in this study were more inclined to apply existing innovations than to develop original innovative solutions. Although they demonstrated strong work engagement, their primary goals were to increase production and secure profit, not to innovate within their farming practices.

Innovations from previous generations that have become local knowledge are often traditionalized into rituals and enacted based on customary strata and habits. As a result, these innovations become sacred and resistant to change. Consequently, farmers face cultural obstacles when they attempt to innovate. Deviating from tradition may be perceived as breaking custom, disrupting the harmony between humans and nature, causing cosmic imbalance, and disturbing social relations (Prabowo & Sudrajat, 2021; Toansiba et al., 2021; Jawan et al., 2025). Because of these taboos and fears of being considered unethical, farmers frequently rely on past innovations instead of developing new ones. Nevertheless, this practice also has positive effects, such as preserving the community's local knowledge and wisdom (Prabowo & Sudrajat, 2021; Toansiba et al., 2021; Jawan et al., 2025).

In addition, farmers often struggle to receive rational or scientific evaluations of their local knowledge (Prabowo & Sudrajat, 2021; Toansiba et al., 2021; Jawan et al., 2025). Although they may observe that certain rituals influence harvests or pest control, they are typically unable to provide logical explanations for these outcomes. Instead, explanations tend to rely on supranatural beliefs that cannot be empirically verified. Consequently, local knowledge tends to describe only the procedures for conducting rituals and the expected outcomes, without explaining the underlying mechanisms. This cultural barrier limits farmers' opportunities to develop innovative work behavior, despite their strong attachment to agricultural work. They essentially act as operators of practices created by previous generations.

Beyond cultural barriers, innovative work behavior—defined as the process of generating innovation—is often associated with intellectual actors such as extension agents, who are assumed to possess superior competencies and skills, as well as agricultural graduates supported by the authority of their universities. Farmers typically lack access to gardens or laboratories where they can develop new agricultural innovations. Their land is generally used not as an experimental space for innovation, but as a site for implementing existing innovations introduced by extension agents. In collaboration with these agents, farmers often conduct pilot projects to demonstrate the outcomes of innovations that have already been developed.

Innovation typically emerges in challenging situations that require immediate solutions. When an idea arises, it is shared and applied collaboratively. However, top-down interventions from government agencies, extension services, and enterprises often limit farmers' opportunities to generate their own ideas and solutions (Fujisawa et al., 2015; Sofia et al., 2022; Singh et al., 2025). As a result, farmers are rarely in a conducive environment to discover or experiment with new ideas; instead, they are expected to adopt existing innovations, either those rooted in cultural heritage or those promoted by government programs.

The third test employed the F-square statistic. An F-square value of 0.020 indicates a low effect, 0.150 indicates a moderate effect, and 0.350 indicates a high effect (Cohen, 1988; Hair et al., 2021). Within the Partial Least Squares Structural Equation Modeling (PLS-SEM) framework, the effect size test (f^2) assesses the strength of relationships among variables. The results of this test are presented in Table 8.

Table 8. Overall F-square

	f-square
Psychological empowerment (X) -> Work Engagement (Y)	0.285
Psychological empowerment (X) -> Innovative work behavior (Z)	1.817
Work Engagement (Y) -> Innovative work behavior (Z)	0.007

Based on the overall test results and generational group analysis, the f^2 value of 0.285 indicates the effect of psychological empowerment on work engagement (X → Y), while an f^2 value of 1.817 reflects the effect of psychological empowerment on innovative work behavior (Y → Z). Referring to Cohen's guidelines (1988) and Hair et al. (2021), an f^2 value of 0.285 is categorized as a moderate effect, an f^2 value of 1.187 is considered very high, and an f^2 value of 0.007 is categorized as very low or insignificant. These findings suggest that psychological empowerment plays a crucial role in fostering work engagement and has a strong impact on innovative work behavior. In contrast, work engagement does not show a significant direct contribution to innovative work behavior, highlighting the importance of prioritizing psychological empowerment as the primary factor within the context of this study.

Figure 2 shows that all external loading indicators are valid in measuring their respective constructs, with loading values exceeding 0.70, thereby meeting the validity standard (Hair et al., 2022). The hypothesis test using the t-statistic for direct effects further indicates that the causal relationships in the measurement model—including correlations between variables and their indicators—are valid and significant, as demonstrated by t-statistic values exceeding 1.96.

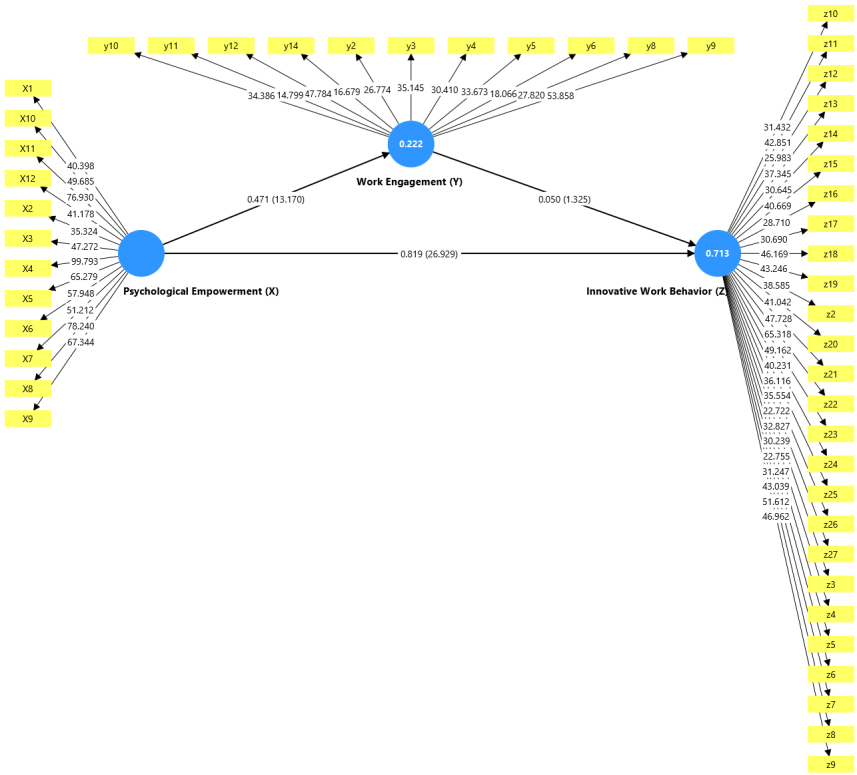

Figure 2. Overall t-statistic hypothesis

Evaluation of Goodness and Model Fit

PLS analysis is a variance-based SEM technique used to test theoretical models with an emphasis on prediction. Several measures are commonly employed to assess the reliability and fit of PLS models, including R-square, Q-square Predict, the Standardized Root Mean Square Residual (SRMR; Hair et al., 2019), PLS Predict (Shmueli et al., 2026), and the Cross-Validated Predictive Ability Test (CVPAT; Liengaard et al., 2021).

R-square represents the amount of variance in an endogenous variable explained by exogenous or other endogenous variables in the model. According to Chin (1998), R-square values can be qualitatively interpreted as follows: 0.19 indicates a low effect, 0.33 a moderate effect, and 0.66 a high effect. The R-square values produced in this study are presented in Table 9.

Table 9. Overall R-square

	R-square	R-square adjusted
Work Engagement (Y)	0.222	0.220
Innovative work behavior (Z)	0.713	0.711

Based on the assessment results using Partial Least Squares Structural Equation Modeling (PLS-SEM), both overall and across generational groups, the coefficient of determination (R^2) for Work Engagement (Y) is 0.222, with an adjusted R^2 value of 0.220. This indicates that psychological empowerment (X) explains 22.2% of the variance in work engagement, while the remaining 77.8% is influenced by other factors not included in the model. According to Hair et al. (2021), this reflects

a weak effect.

In contrast, for the Innovative Work Behavior (Z) variable, the overall and generational R^2 value is 0.713, with an adjusted R^2 of 0.711. This means that 71.3% of the variance in innovative work behavior is explained by the combined effect of psychological empowerment (X) and work engagement (Y). This value is classified as a substantial effect. Therefore, although psychological empowerment has a relatively small direct effect on work engagement, when paired with work engagement, both variables contribute significantly to explaining innovative work behavior.

Q-square (Q^2) is a measure of predictive accuracy used to assess how well changes in exogenous (independent) and endogenous (dependent) variables predict work engagement and innovative work behavior, both overall and by generational groups such as millennials and older generations. Q^2 serves as a validation metric in PLS-SEM for determining predictive relevance. The Q^2 value is obtained through a blindfolding procedure and represents an improvement over earlier versions of the metric. A Q^2 value greater than 0 indicates acceptable predictive relevance. According to Hair et al. (2019), a Q^2 value above 0 indicates low predictive relevance, a value above 0.25 indicates moderate predictive relevance, and a value above 0.50 indicates high predictive relevance. The Q-square prediction values are presented in Table 10.

Table 10. Q Square Predict

	Q^2predict
Work Engagement (Y)	0.211
Innovative Work Behavior (Z)	0.710

Based on the overall testing and the generational groups, a Q^2 value of 0.211 was obtained for the Work Engagement (Y) variable and a value of 0.701 for the Innovative Behavior (Z) variable. Because both values exceed zero, the results indicate that the research model has acceptable predictive relevance overall. More specifically, a Q^2 value of 0.211 reflects moderate predictive ability for the Work Engagement variable, meaning the model is able to estimate variations in work engagement with a moderate degree of accuracy. In contrast, a Q^2 value of 0.701 demonstrates strong predictive ability for the Innovative Behavior variable, indicating that the model is highly effective in explaining and predicting changes in innovative behavior.

The Standardized Root Mean Square Residual (SRMR) is a measure of model fit in PLS-SEM. SRMR compares the estimated model correlation matrix with the empirical correlation matrix. An SRMR value below 0.08 indicates good model fit (Hair et al., 2017), while values between 0.08 and 0.10 are considered acceptable (Schermelleh-Engel et al., 2003). The SRMR values for this study are presented in Table 11.

Table 11. Overall SRMR

	Saturated model	Estimated model
SRMR	0.058	0.058

Based on the results of the Goodness of Fit test, both overall and across generational groups, the

Standardized Root Mean Square Residual (SRMR) value obtained was 0.058. Because this value is below the 0.08 threshold, it can be concluded that the research model demonstrates good fit and meets the established criteria. Thus, the structural model developed in this study is acceptable and appropriate for further analysis. The overall PLSpredict results show that all Q^2 Predict values are greater than zero, indicating that the model has predictive relevance. However, comparisons of the Root Mean Square Error (RMSE) and Mean Absolute Error (MAE) between the PLS-SEM model and the linear model (LM) reveal varying outcomes. The detailed PLSpredict results are presented in Table 12.

Table 12. overall PLS Predict value

	Q^2 predict	PLS Model		LM Model		Difference between PLS and LM models	
		RMSE	MAE	RMSE	MAE	RMSE	MAE
y2	0.143	0.746	0.542	0.716	0.511	0.030	0.031
y3	0.168	0.954	0.668	0.930	0.639	0.024	0.029
y4	0.139	0.803	0.549	0.785	0.544	0.018	0.005
y5	0.158	0.889	0.616	0.862	0.596	0.027	0.020
y6	0.095	1.373	0.896	1.306	0.855	0.067	0.041
y8	0.182	0.775	0.544	0.776	0.533	-0.001	0.011
y9	0.167	0.782	0.577	0.742	0.540	0.040	0.037
y10	0.127	0.979	0.643	0.957	0.601	0.022	0.042
y11	0.085	1.392	0.902	1.336	0.877	0.056	0.025
y12	0.171	1.037	0.714	1.000	0.709	0.037	0.005
y14	0.128	1.206	0.790	1.168	0.771	0.038	0.019
z2	0.527	0.555	0.395	0.576	0.393	-0.021	0.002
z3	0.540	0.532	0.368	0.551	0.351	-0.019	0.017
z4	0.431	0.608	0.462	0.626	0.447	-0.018	0.015
z5	0.324	0.733	0.587	0.667	0.529	0.066	0.058
z6	0.337	0.654	0.527	0.642	0.517	0.012	0.010
z7	0.491	0.549	0.454	0.546	0.435	0.003	0.019
z8	0.623	0.547	0.463	0.530	0.422	0.017	0.041
z9	0.562	0.551	0.429	0.549	0.414	0.002	0.015
z10	0.413	0.641	0.508	0.627	0.467	0.014	0.041
z11	0.525	0.595	0.454	0.611	0.442	-0.016	0.012

z12	0.265	0.803	0.687	0.782	0.655	0.021	0.032
z13	0.389	0.687	0.559	0.662	0.545	0.025	0.014
z14	0.362	0.705	0.589	0.717	0.585	-0.012	0.004
z15	0.468	0.642	0.504	0.621	0.491	0.021	0.013
z16	0.297	0.813	0.625	0.782	0.613	0.031	0.012
z17	0.467	0.646	0.520	0.652	0.508	-0.006	0.012
z18	0.517	0.611	0.474	0.612	0.455	-0.001	0.019
z19	0.478	0.618	0.493	0.629	0.492	-0.011	0.001
z20	0.462	0.615	0.525	0.628	0.517	-0.013	0.008
z21	0.491	0.597	0.478	0.602	0.477	-0.005	0.001
z22	0.594	0.606	0.507	0.619	0.498	-0.013	0.009
z23	0.545	0.592	0.490	0.598	0.465	-0.006	0.025
z24	0.496	0.588	0.485	0.583	0.475	0.005	0.010
z25	0.487	0.589	0.464	0.593	0.457	-0.004	0.007
z26	0.412	0.665	0.529	0.654	0.524	0.011	0.005
z27	0.402	0.636	0.526	0.625	0.500	0.011	0.026

Based on the comparison of the PLS-SEM_RMSE and LM_RMSE values in the tables above, 13 items (36%) out of a total of 12 scales were found to have smaller PLS-SEM_RMSE values compared with LM_RMSE. In addition, 36 items overall showed larger PLS-SEM_MAE values than LM_MAE. These results indicate that although the PLS-SEM model demonstrates predictive capability, its overall predictive accuracy is lower than that of the linear model. Consequently, the model's predictive ability can be categorized as weak or limited (limited predictive relevance). According to Hair et al. (2021), a PLS-SEM model is considered to have good predictive performance when most indicators show smaller prediction error values (RMSE and MAE) compared with the linear model. In this study, this condition was not fully met, indicating that the model's predictive performance is weak; however, it remains relevant because all Q^2 Predict values are positive.

Differences in Psychological Empowerment, Work Engagement, and Work Innovation Behavior between Older and Younger Generation Farmers

The difference test revealed significant differences in psychological empowerment, work engagement, and innovative work behavior between older and younger farmers. Younger farmers reported higher levels of psychological empowerment, work engagement, and innovative work behavior compared with their older counterparts. The results of the difference test are presented in Table 13.

Table 13. Mann-Whitney U-test results

Test Statistics[a]			
	Psychological empowerment (X)	Work Engagement (Y)	Innovative work Behavior (Z)
Mann-Whitney U	11810,000	12103,000	9718,000
Wilcoxon W	56063,000	56356,000	53971,000
Z	-4,109	-3,644	-5,938
Asymp. Sig. (2-tailed)	,000	,000	,000

In terms of quantity, the older generation of farmers outnumbers the younger generation. However, the results of this study show that, in terms of quality, the younger generation demonstrates higher mean scores than the older one.

These findings are consistent with previous research showing that young farmers tend to be more empowered than older farmers (Qonita et al., 2025). Younger farmers generally have greater capacity to master technology, both in production processes and in marketing their agricultural products. They also tend to have higher levels of education and greater access to agricultural information and skills through digital technologies (Qonita et al., 2025). Older farmers typically perceive farming as a hereditary activity focused primarily on producing food for subsistence. In contrast, younger farmers view farming as a business activity that not only ensures food availability but also generates income from the sale of agricultural products. Younger farmers also tend to be more active in building networks and communication, both offline and online, including through social media. Given these conditions, the younger generation of farmers tends to attribute greater meaning to their profession and perceives themselves as having more autonomy in making decisions related to production, marketing, and business development. Although the number of farmers continues to decline, the quality of those who remain appears to be improving.

Young farmers consistently exhibit higher levels of innovative work behavior than older farmers. This study assessed innovative work behavior by emphasizing farmers' ability to create new ideas and solutions rather than merely adopting existing innovations. The significant differences found between young and older farmers indicate that younger farmers tend to demonstrate greater creativity, problem-solving skills, and capacity to generate and promote new ideas. These findings are reasonable and align with previous studies showing that younger farmers typically display higher levels of innovative work behavior.

The three sets of results—showing that young farmers score higher in psychological empowerment, work engagement, and innovative work behavior—provide important insights into the quality of human resources in agriculture from a psychological perspective, an angle that has rarely been examined in agricultural research. These findings suggest that although the number of farmers in Indonesia is declining, the quality of existing human resources is improving. Becoming a farmer is

no longer merely an option for the unemployed; rather, those who choose the profession increasingly demonstrate competence, engagement, and the capacity to innovate.

CONCLUSION

The results of this study indicate that farmers' work engagement does not mediate the relationship between psychological empowerment and innovative work behavior. Psychological empowerment directly influences innovative work behavior and also affects work engagement. However, because work engagement does not significantly influence innovative work behavior, it cannot function as a mediating variable.

These findings suggest that farmers' innovative work behavior is shaped more by deductive innovation dissemination—such as innovations introduced through government programs or non-governmental organizations—than by farmers' own initiatives. Additionally, many traditional farmers continue to rely on ancestral knowledge and long-established agricultural practices rather than initiating new innovations independently.

A limitation of this study is that the participants were members of farmer groups who are accustomed to receiving deductive innovation from extension agents. This may have reduced their tendency to develop innovative behavior autonomously.

Based on these conclusions, future research should consider testing innovative work behavior as a mediator between psychological empowerment and work engagement. It is possible that involvement in innovative activities introduced by extension workers may contribute to increased work engagement among farmers.

Although the number of young farmers is declining, this study shows that younger farmers who remain in agriculture tend to have higher levels of psychological empowerment, work engagement, and innovative work behavior than older farmers. This indicates that younger farmers represent a promising generation with the potential for continued development. Conversely, older farmers may require targeted interventions to enhance psychological empowerment, work engagement, and innovative work behavior. Therefore, future studies could employ quasi-experimental or action research designs to develop and test interventions aimed at strengthening these psychological constructs among older farmers, particularly those who remain productive in the 40–50 years age range.

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